University of Alberta

Integrated Mediterranean Farming and Pastoral Systems: Local Knowledge and Ecological Infrastructure of Italian Dryland Farming

by

Franca Elise Boag ©

A thesis submitted to the Faculty of Graduate Studies and Research in partial fulfillment of the requirements for the degree of Doctor of Philosophy

Department of Anthropology

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ABSTRACT

The focus of this dissertation research is the systemic relationships between farming and pastoralism in the Basilicata region of southern Italy, investigating traditional, local agro-pastoral practises for similarities and differences across ecological habitats and altitudinal (vertical) gradients. Through fifteen months' field research I found that a common infrastructure exists between communities and across geographical zones, consisting of a long established integration of sheep and goats within cereal and forage legume rotations. The systemic relationships are an integral part of the larger Mediterranean environment, characterized by a vegetation mosaic composed of non-arable, spontaneous ("wild") plant communities (*macchia* and predominantly oak copses), sown fields, and fallow lands. Local ("traditional") knowledge embedded in technologies of prescribed burning and controlled grazing maintain a sustainable, productive environment in cultivated areas and in non-arable areas where fire, sheep and goats are the primary tools used by shepherds to maintain and renew plant communities. *Pastori* (shepherds/goatherders) move flocks of sheep and goats across diverse plant communities, thereby continually reintroducing selected plant species through seeds which survive the digestive process, are germination-enhanced by that same process, and are "sown" in their faeces. I conclude that sheep and goats are used both as agricultural tools and in maintaining plant productivity in non-arable areas, but especially as selective agents giving rise to mutualistic relationships that have coevolved between them (sheep and goats) and the plant communities upon which they rely. Thus I demonstrate how agricultural and pastoral technologies are integrated in practise through "traditional", local knowledge, and how these traditional and sustainable systems are both created by and create their environment. The transmission and persistence of this knowledge which integrates

herding and farming is insured by the mutually beneficial relationship, while the way they are integrated in practise constitutes mixed farming. The flexibility of the systemic relations between farming and herding enables producers to shift production goals in response to market variations and poor growing seasons, and is essential to its stability and pivotal to its success in South Italy.

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CHAPTER 1
INTRODUCTION

Statement of purpose

This study employs an ecological and historical approach to analysing contemporary, traditional south Italian farming and pastoralism in the Basilicata region.[1] Through this study I identify an infrastructure composed of interrelated cereals, legumes, sheep and goats in oral history and contemporary Mediterranean pastoral and dryland farming practises.[2] I compare the systemic relationships between agriculture and pastoralism across ecological zones and altitudinal gradients to determine whether they share an infrastructure, and if so, to identify its composition. I trace the elements of this postulated infrastructure, and how they are configured in order to determine how the infrastructure varied historically, and does so presently in modern Italian pastoralism and farming. At the core of this study is an analysis of the biological elements involved, how agriculture and pastoralism are integrated in practise through local knowledge, and how traditional, sustainable farming and herding practises create and are created by their environment.

Origins of the study

Like most dissertation research, this question was not born of a flash of independent insight; instead it builds upon past research and reflects an amalgamation of interests -- mine due to previous experience, and those of Dr. Henry T. Lewis. In particular, it derives from Dr. Lewis' interest in the origins of agriculture (1972); his extensive research of the broader context of human adaptation to and management of their environment, particularly through the use of fire. As Dr. Lewis' student in the undergraduate program, I became fascinated with his analysis of human management of ecosystems in creating and maintaining productive environments, fostering the interrelationships between organisms. Towards the end of my MA program at Carleton University, he proposed that I return to the University of Alberta to undertake research in southern Italy and examine the role of fire in traditional agriculture. The question has an extensive precedent in Dr. Lewis' research in fire technology over the last two decades (e.g. Lewis 1972, 1985, 1989a, 1989b, 1991a, 1991b), but was stimulated principally by his personal observations in 1990 of burning in the area of Oppido Lucano (Basilicata, South Italy), and patterns of burning studied in the course of his recent research in Australia (Lewis and Boag n.d.).

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[1] Basilicata is the modern name for the region under study. It is the original Greek name acquired under Greek colonization during the 8th - 4th centuries BC. It is used interchangeably with the Roman version, Lucania, which is also applied as a general referent for the Italic tribes inhabiting the area (Lucanians) (Gaetani 1981:10; Lomas 1993:1-37).

[2] Oral history elicits information beyond current practise. Fortes (1953:42) remarks: "[T]he synchronic unit is not necessarily the year or two devoted to field-work. It is more correctly the span of at least three generations represented in the age and descent range usually found in living communities." Oral history extends local knowledge of practise at least one further generation.

My previous experiences in southern Italy also shaped this research. In 1982 I participated in the archaeological excavation of a Roman villa (San Giovanni di Ruoti) in the province of Potenza, Region of Basilicata, within 30 km of Oppido Lucano (see Small and Buck 1994). During my stay in the area, I noticed the small scale of agriculture and pastoralism practised by the local population, and their reliance upon labour-intensive, non-industrial technology. This experience was augmented by another during the summer of 1984 in a geographically dissimilar area of south Italy (Roccagloriosa, at the border between Campania and Calabria) (Gualtieri 1993). Again I observed that the practise of agriculture and pastoralism appeared to be grounded in tradition without industrial inputs. These experiences originally inspired a research project to investigate reasons for the persistence of small farms and non-industrial inputs in the face of national efforts to industrialize agriculture in the Italian south over the last 40 years (Bonanno 1987).

The focus of research shifted following interviews with Edmonton residents who had been mixed farmers in southern Italy before migrating to Canada. Information they provided, and clear parallels to technologies described by ancient Greek and Roman agronomists, led me to investigate the persistence of agro-pastoral technologies as evidence of local ecological knowledge born of adaptations to a particular environment. It is this research program which is set out here.

The formulation of this study was also influenced by recent research undertaken by Dr. Henry T. Lewis. Lewis (Lewis and Boag n.d.) proposes that south Australian dryland or ley farming represents a modern application ("re-invention") of an ancient agro-ecological system. The skeleton or basic infrastructure of this mediterranean[3] dryland farming system is composed of interrelated elements: cereals in rotation with annual forage/pasture legumes, managed through the use of sheep and fire. Investigated through this study is whether these same components, an agro-pastoral infrastructure, underlie dryland farming in the Mediterranean.

Leach (1961) proposes a theoretical framework for analysing differences between groups: as combinations and recombinations of a general rule or pattern, what I term the "basic infrastructure". In this dissertation, I postulate that Australian ley farming is an analogue for the basic infrastructure of the ancient dryland Mediterranean agro-ecosystem. Consequently, the dryland farming infrastructure is envisaged in terms of the south Australian example in which sheep, cereals, legumes and fire form an integrated system. By tracing these biological components and their associations through time, I seek to determine "whether similar adjustments occur in similar environments . . . . [and trace these] through a succession of very unlike periods" (Steward 1955:42).

The social, political and economic settings of agriculture and pastoral production are central components of "traditional" ethnography of agro-pastoral societies. However, here they are discussed only as they impinge upon the biological components and integrating technologies which are the subjects of this study. During fieldwork, I interviewed individuals involved in farming from all social - political classes (in the traditional Marxian sense) and with varying amounts of property, including agricultural labourers with none (property size and ownership was found to be correlated to relative wealth and political affiliation). This cross-section of individuals revealed a coherence of practise despite economic differences and variations in production goals. For example, differences in land tenure (communal or private) described by Orlove (1980:250), result from social-political situation. The different patterns ". . . are the outcome of a long history of interaction between environment, social structure, and culture in the valley and surrounding region" (Orlove 1980:255). However, such differences do not alter the intrinsic structure of the systemic relationships between farming and herding. Discussed below, variations within and between communities are broadly defined by land tenure (economic) status and topography. Consequently, I shall limit my discussion to agricultural and pastoral practises; the broader social, political, and economic setting in which agriculture and pastoralism occurs is discussed only as it impinges upon practise.

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[3] In the traditional sense, and as applied here, Mediterranean refers strictly to that geographical region encircling the Mediterranean Sea. For those other regions such as Australia, California and South Africa, mediterranean has been adopted because of climatological similarities (winter rainy growing season, summer drought) (Hobbs et al. 1995:4).

This study is not in the strict sense, ethnography. Knowledge of farmers and sheep and goat herders, hereafter referred to as *pastori*,[4] is traditional, technical information: descriptions of the environment in which farming and pastoralism are embedded; their knowledge, enacted through practise, is grounded in an intimate understanding of local ecology, agronomy, animal behaviour and nutrition, and so on. Their understanding extends beyond a single community and transcends disciplinary boundaries, encompassing the experience of specialized producers (almost exclusively men) in several communities. Consequently, my research required a detailed consideration of data and interpretations from numerous other disciplines (e.g. agronomy, botany, animal science, ecology) beyond anthropology. This research and its results are broader than any single field from which I have drawn. Studying technological, ecological knowledge necessitates a broader, multidisciplinary approach. In this, I follow in the footsteps of H.T. Lewis (e.g. 1972, 1977, 1985, 1989a, 1989b, 1991a, 1991b, 1993), M.K. Anderson (1994, 1993), M.A. Altieri and M.K. Anderson (1992, 1986), and Koster (1977), among others.

The History of Research in South Italian Agro-Pastoralism

Anthropological research in the south of Italy has been dominated by studies of economic "development". Foster's (1961, 1965) concept of the "image of limited good" encouraged similar studies of south Italian communities. Researchers developed new concepts such as "amoral familism" or" introverted nuclear family structures" (Banfield 1958, criticized by Silverman 1968), "peasant" fatalism, *campanilismo*,[5] and honour and shame.[6] These studies drew from psychology to explain the presumed inability of small-scale farmers ("peasants") to cooperate in development initiatives, evident in a reluctance to cooperate with authorities. Sicily and Calabria have also attracted researchers because of the regional history of banditry, mafia, and codes of silence *(omertá)*. Anton Blok's study of mafia (1974) initiated other studies of Sicilian rural society (e.g. Arlacchi 1986, 1983; Sabetti 1984; Schneider and Schneider 1976) that went beyond analyses of values and morals to examine the relationship of "peasant" and State in Sicily (e.g. Schachter 1965, Bonanno 1987). Other than Banfield's (1958) study, anthropological studies of the study area (Basilicata-Lucania), include the famous Sud e Magia, a study of South Italian, but particularly Lucanian spiritual, traditional beliefs (de Martino 1959), and John Davis' ethnography, Land and Family in Pisticci (1973).

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[4] The English term 'shepherd' signifies a herder of sheep. Because flocks in Basilicata traditionally are composed of both sheep and goats, I use the Italian term *'pastore'* (*pastori*, plural), which embraces both, and is the designation used in the area.

[5] *Campanilismo* is an attachment to one's home town.

All of these were preceded by the influential Christ Stopped at Eboli (1947) by Carlo Levi, a descriptive account of the poverty and *miseria* in Basilicata during the late 1930s,[7] and even earlier by Giustino Fortunato in the late 19th century who advocated massive structural reforms (Gaetani 1981:13-32). These publications and the many that followed[8] had a revolutionary effect in raising the consciousness of Italians generally, about conditions in the South, and catalysed development initiatives such as the post-war Agrarian Reform and the creation of the development fund for the Italian South (*Cassa per il Mezzogiorno*).[9]

Other important descriptions of life in Basilicata include Ann Cornelisen's Women of the Shadows (1976). Further north, ethnographies of central Italy such as Silverman's Three Bells of Civilization (1975), and Feliks Gross' (1973) Il Paese investigated village social structures and values, but with an eye to property and class relationships. More recent ethnographies in South Italy, such as Anthony Galt's work in Locorotondo (Apulia), follows in this ethnographic tradition (see also Marapsini's 1968 ethnography of an Apulian town), examining property relations (land tenure) and settlement patterns (1991a, 1991b, 1991c, 1992) while moving away from the political-economic studies of "ethos" inspired by Foster's and Banfield's work.

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[6] The" honour and shame" school which has dominated Mediterranean ethnography (e.g. Peristiany 1965; Schneider 1971) has been much criticised for its undervaluation of the role of women (e.g. Cole 1991; Herzfeld 1984, Saller and Kertzer 1991:17-18).

[7] Eboli is a small town south of Naples, the road south from which marks the beginning of the ascent into the Apennines and a rural world dominated by hill and mountain-top villages. "The peasants themselves had said for centuries, *Cristo si è fermato a Eboli.* Those south of Eboli . . . are thus by ascription neither part of Christianity nor of the civilized world" (Gaetani 1981:10).

[8] See Gaetani (1981) for a review of this literature (both literary essays and scholarly works) and Troisi (1979) for excerpts of these.

[9] Briefly described below (Chapter 2), the legislation was only partly successful and implemented only following upon large scale revolts in rural and urban areas of the south, especially, Calabria, Basilicata, the Abruzzi and Sicily (Ginsborg 1990:121-140).

Most of the Italian anthropological/sociological research and literature is couched in light of the "problem of the Italian south (the Mezzogiorno)" (e.g. Troisi 1979; Gaetani 1981). Its development orientation *ab initio* dismisses traditional practise as "archaic" and detrimental to development.[10] This literature is of limited value to my research. In fact, "traditional" farming and pastoralism have been considered of value recently for their worth to the tourism industry, and as a means of retaining a particular cultural landscape (e.g. Rugani 1988), but not for their value as sustainable systems. On the other hand, studies from other disciplines such as history, classics, archaeology, agronomy and animal husbandry are of particular value to me. Worthy of mention here, is the Argolid Exploration Project[11] which has produced a vast body of relevant literature encompassing ethnography, history, and archaeology (e.g. Davis 1996; Jameson et al. 1994; Hansen 1991a, 1991b). The Argolid project literature will be discussed in greater detail below.

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[10] In this "post-colonial" present, "development" became both a political tool of control and an industry dominated by western science. As Hobart (1993:1-2) points out, a state of ignorance must be assumed in order to rationalize programs of development -- the perception of the south Italian "peasant" (the targets of development initiatives) as ignorant and resistant to change continues to prevail in Italy.

[11] The Argolid Exploration project (AEP) was a multidisciplinary American regional study which began in 1950 and ended 1983. Its goals were to produce thorough documentation of the prehistory and history of this important area of Greece through archaeological survey and excavation, ethnoarchaeology, ethnography, ethnobotany and, geomorphology (Davis 1996).

METHODS

Field research sites were selected on the basis of their geographical location: their altitude and topography (and therefore varying annual precipitation). The site selection process is detailed below. Maps and aerial photographs were used to locate pastures, sheep/goat folds and farms, in order to establish grazing radii and elevations above sea level (a.s.l.).

The primary data were gathered through formal, structured interviews and informal interviews were undertaken with herders of mixed sheep and goat flocks, farmers, individuals engaged in both herding and farming, and agricultural labourers. I attempted the use of a questionnaire, but did not find it helpful. The sensitive nature of some of the information I sought, made the use of a questionnaire difficult. The problems of eliciting statistical data regarding numbers of livestock and sown crop areas are described fully in the relevant sections below. Reviewed by ethics committees at both the University of Alberta and by the granting agency (Social Science and Humanities Research Council of Canada), this research was conducted with strict adherence to the ethics guidelines for research with human subjects and its guarantees of informant anonymity. Furthermore, ethical problems such as those described by Punch (1986) were avoided by complete disclosure to all informants of the research goals, and exclusion of materials that might have foreseeable, potential negative consequences for informants.

Other methods employed throughout the fifteen months of field research involved observation and participation in many aspects of community life, pastoral and agricultural activities. These data were supplemented by archival research of relevant documents where these could be obtained. Archival records were found to be incomplete and unreliable for reasons elucidated in the text (see especially, Appendix B, *Fida Pascolo* Records). Similarly, government statistics from the recent agricultural census (ISTAT 1991) were examined and also found to be unreliable.

Supplementary information was amassed from relevant archaeological reports, ethnographies, government publications, agronomists' and animal scientists' reports, journal articles and so on. I also appealed for specific information to veterinarians, reforestation and forestry officers, meteorologists, animal and plant scientists at Italian national, regional and university-based research institutes. The information gathered from these sources is documented in the relevant sections.

Seed and whole plant samples were collected. The identification of plants was made with reference to a number of manuals for Italian, European and Mediterranean flora (e.g. S.I.L.M. 1989; Aichele, Schwegler 1981; Simonetti and Watshinger 1986). Identifications were checked by botanists and agronomists from the universities of Bari and Basilicata. To increase the reliability of identification and to create a record and thus the opportunity for later corroboration of identification, photographs were taken of the plants identified by *pastori* as particularly important.

Faecal pellet samples were also collected from sheep/goat folds in the study area. Initial seed identifications from the faecal pellets were verified by palaeobotanist Lorenzo Costantini (I.S.M.E.O., Rome). Other seed identification guides were referred to, such as Hanf (1982), Baldoni et al. (1974), Beijernick (1947), Kernick (1978), Urban (1873), Delorit and Gunn (1986), and Montgomery (1977).

The selection of research sites

The Mediterranean Basin is defined by its climate of dry summers and mild, wet winters. Annual precipitation may vary between 275-1500 mm of which 65% or more falls during the winter (Dell et al. 1986:1). Proximity to coast, location in relation to prevailing winds, and altitude all contribute to great climatological variability (Buddenhagen 1990:5; Campbell 1994:8-10). Geographically the Mediterranean Basin is characterized by high mountains and hills with complex ridges and steep slopes (Naveh 1987:643). The rugged terrain and variation in altitude causes great variability in microclimates and a vegetation mosaic (Buddenhagen 1990:6-7; Campbell 1994:14-18). Topographic variation within relatively small areas (proximity of features such as a valley, plain and mountain) allows comparison of farms in montane zones with those located on valley plains, and those that embrace both areas -- what Higgs and Vita-Finzi (1972:30) describe as "an annual territory" on a large scale. For my purposes, an "annual territory" is defined more appropriately as an agro-pastoral territory. For Chang (1992:67), ". . . pastoralism [is] a system of spatial organization over a total landscape. . .", in which landscape analysis forms the central analytical tool. I adopt this perspective such that both agriculture and pastoralism are considered to be 'systems spatially organized over and employing the total landscape.'

> This [Mediterranean] zone corresponds to a historically and culturally rich and complex [ecological and environmental] unit where agriculture has always been

> carried out under difficult natural conditions of seasonal and irregular precipitation, eroded soil, pronounced relief, and the association of certain xerothermic plants . . . (Boyazoglu and Flamant 1990:354).

Within the larger Mediterranean climate type, there is little agreement over the defining range of precipitation for dryland or semi-arid areas (definitions vary from 150 to 800 mm per annum) (e.g. Dietz 1987:36; Boyazoglu and Flamant 1990:357,361; Wilson 1982:310; Le Houérou 1981:486).

> There is unfortunately no absolute threshold dividing a "semi-arid" from any other type of climate, since factors such as temperature and rainfall *distribution* as well as total amount of rainfall affect the extent of a climate's aridity" (Forbes 1982:203).

However, common to all definitions and the pivotal characteristic of dry lands is seasonal, growth-limiting drought. Because of variability in the study area and disagreement among specialists, I shall use Squires' (1991:3) comprehensive definition:

> Dryland farming, also called rain-fed agriculture, is practised in regions where lack of moisture limits crop and/or pasture production to part of the year. . . . the growing season and varies from a few months to about nine months in a 'normal' year. Rainfall is often low and variable but the more successful dryland farming systems have been established where rainfall (however low) is reliable and the start and finish of the growing season are fairly predictable.

Therefore, dryland farming is identified according to its adaptation to the growth-limiting factor of seasonal precipitation. Large variations in precipitation are significant within the study area and are important to the study.[12] These variations appear in the relevant sections of the text, whereas more comprehensive tables and charts of precipitation and temperature values are set out in Appendix C.

West-central Sicily was selected initially as the locus of study. However, the Region of Basilicata and specifically, the town of Oppido Lucano and its environs, was chosen because it offered a number of advantages absent in Sicily. First, I was already familiar with Basilicata and its regional dialect. Both factors would help me to orient myself in the community. Furthermore, an opportunity presented itself for joint research with Dr. H. Fracchia (Department of History and Classics, University of Alberta) and Dr. M. Gualtieri (*Istituto di Studi Comparati sulle Società Antiche, Università degli Studi di Perugia*). Fracchia's and Gualtieri's interests lie in determining whether structural changes in local economies can be extrapolated from the archaeological and survey data (e.g. Gualtieri and Fracchia 1993; Gualtieri 1994). Their archaeological investigation of the Romanization of Lucanian populations through reconstructions of local economies complements my interest in past farming and herding strategies; the archaeological data provides faunal and botanical evidence and the site survey documents settlement patterns through time. Although their research focuses on a specific period of Lucanian history, their excavation and survey of the territory surrounding Oppido provides detailed information important to the broad, diachronic perspective of my project.

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[12] In drier areas, barley-based farming systems tend to be found in zones where annual precipitation is limited to 200-300 mm, whereas wheat-based systems tend to be found in areas of 300 mm or more of rainfall (Jones 1990:195-6; Boyce et al. 1991:254). However, there is a good deal of overlap between the two, and commonly wheat and barley may be grown within the same farm although one or the other is the primary crop. In a Mediterranean barley-based system, the focus of production is assumed to be upon livestock, in particular, sheep and goats. In the case of wheat dominated, mixed farming systems, it is assumed that wheat is the "cash" crop (Boyce et al. 1991:254). These distinctions cannot be made according to rainfall in Basilicata where annual precipitation exceeds the 300 mm dividing line between the two systems.

I originally set out to undertake a 'controlled comparison' (Eggan 1954) of diversified, dryland, small-scale farming in the Lucanian Apennines of the Basilicata Region (see Figures 1-3). The comparative method establishes a basis for measuring ". . . the degree and range of the regularities we discover" (Fortes 1953:41), and in this case, a controlled comparison would allow me to establish whether the postulated infrastructure of dryland, rainfall based farming and pastoralism could be identified. The two communities selected are located in valleys at approximately the same latitude (40° 44'N), but separated by some 30 km, and have ancient agrarian histories.

Both sites (Oppido Lucano and San Giovanni di Ruoti) are located centrally within the Apennine mountain range in dryland farming zones. I anticipated that differences between farming and herding strategies within one valley would be greater than those between valleys given the topographical relief and zonation of plant communities within each valley. The two valley systems share similar environments, one located in the Avigliano *fiumara* (river valley) (a tributary of the Sele River that drains into the Tyrrhenian Sea) in the vicinity of the town of Ruoti, and the other in the Upper Bradano Valley (draining into the Gulf of Taranto and thence the Ionian Sea) centred upon Oppido Lucano (Figure 4).

For comparative purposes, the cultural and economic histories of the area are

Figure 1: South Italy showing position of Minervino Murge. Adapted from Small (1992:165).

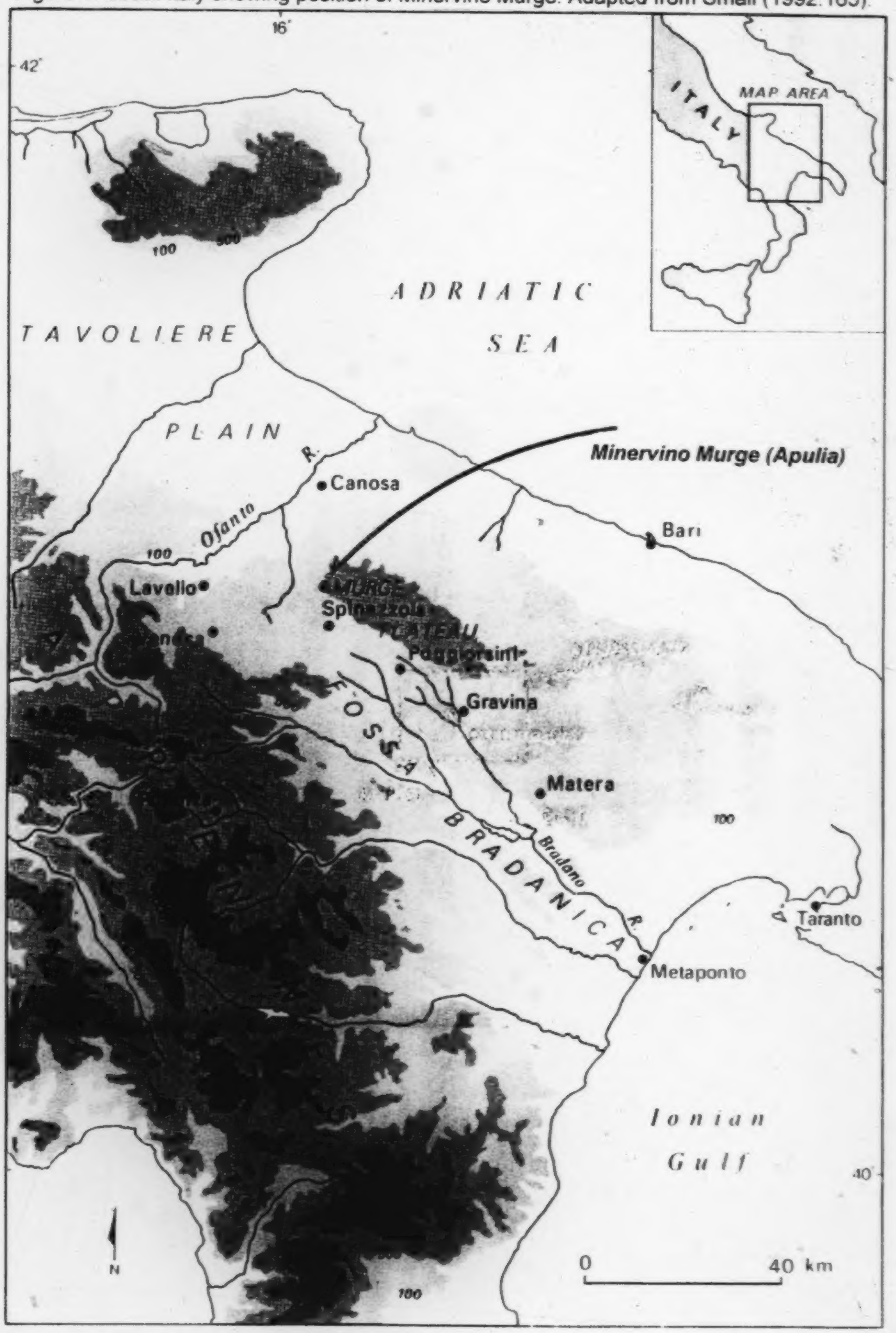

16°
42°
ITALY
MAP AREA
100
500
ADRIATIC
SEA
TAVOLIERE
PLAIN
Ofanto
R.
Canosa
Minervino Murge (Apulia)
Bari
100
Lavello
MURGE
Spinazzola
PLATEAU
Poggiorsini
Gravina
FOSSA
BRADANICA
Matera
100
Bradano
R.
Taranto
Metaponto
Ionian
Gulf
40°
N
0
40 km
100

Figure 2. Basilicata municipalities. Map adapted from that provided by the Dipartimento Tecnico-Economico per la Gestione del Territorio Agricolo-Forestale, Università degli Studi della Basilicata.

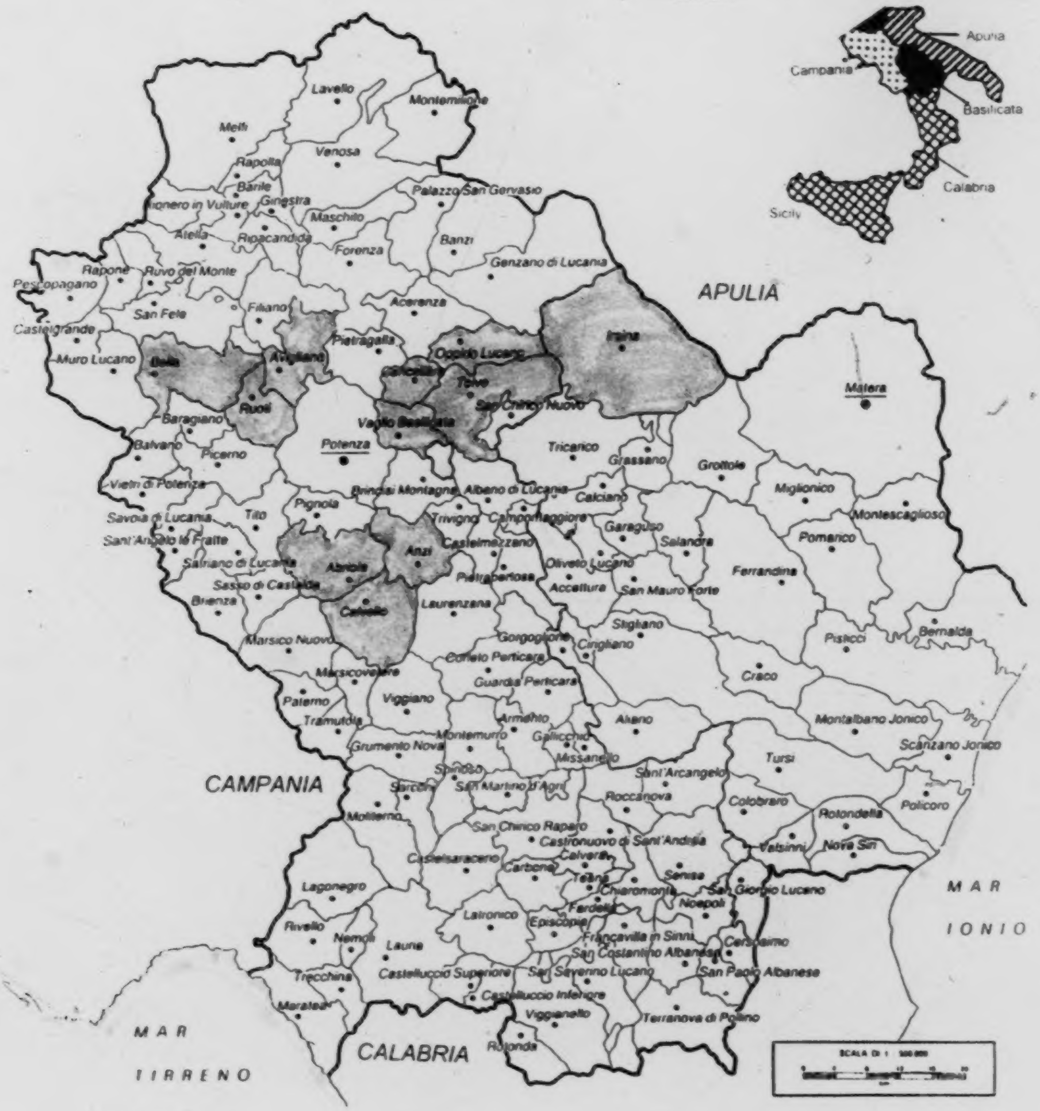

Apulia
Campania
Basilicata
Calabria
Sicily
APULIA
CAMPANIA
CALABRIA
MAR TIRRENO
MAR IONIO
SCALA DI 1 : 500.000
Lavello
Montemilone
Melfi
Venosa
Rapolla
Barile
Rionero in Vulture
Ginestra
Palazzo San Gervasio
Maschito
Atella
Ripacandida
Banzi
Forenza
Genzano di Lucania
Rapone
Ruvo del Monte
Pescopagano
San Fele
Filiano
Acerenza
Castelgrande
Irsina
Pietragalla
Oppido Lucano
Muro Lucano
Bella
Avigliano
Cancellara
Tolve
Ruoti
San Chirico Nuovo
Matera
Baragiano
Vaglio Basilicata
Potenza
Balvano
Picerno
Tricarico
Grassano
Grottole
Vietri di Potenza
Brindisi Montagna
Albano di Lucania
Calciano
Miglionico
Savoia di Lucania
Tito
Pignola
Trivigno
Campomaggiore
Garaguso
Montescaglioso
Sant'Angelo le Fratte
Castelmezzano
Salandra
Pomarico
Satriano di Lucania
Anzi
Abriola
Oliveto Lucano
Ferrandina
Sasso di Castalda
Pietrapertosa
Accettura
San Mauro Forte
Brienza
Calvello
Laurenzana
Stigliano
Marsico Nuovo
Gorgoglione
Cirigliano
Pisticci
Bernalda
Corleto Perticara
Marsicovetere
Guardia Perticara
Craco
Paterno
Viggiano
Tramutola
Armento
Aliano
Montalbano Jonico
Montemurro
Gallicchio
Grumento Nova
Missanello
Scanzano Jonico
Tursi
Spinoso
Sant'Arcangelo
Sarconi
San Martino d'Agri
Roccanova
Colobraro
Policoro
Moliterno
Rotondella
San Chirico Raparo
Castronuovo di Sant'Andrea
Valsinni
Nova Siri
Castelsaraceno
Calvera
Carbone
Teana
Senise
Lagonegro
Chiaromonte
San Giorgio Lucano
Noepoli
Fardella
Latronico
Episcopia
Rivello
Francavilla in Sinni
Nemoli
Cersosimo
Lauria
San Costantino Albanese
Trecchina
Castelluccio Superiore
San Severino Lucano
San Paolo Albanese
Castelluccio Inferiore
Maratea
Viggianello
Terranova di Pollino
Rotonda

Figure 3: Basilicata Elevations. Adapted from Basilicata (1993:24).

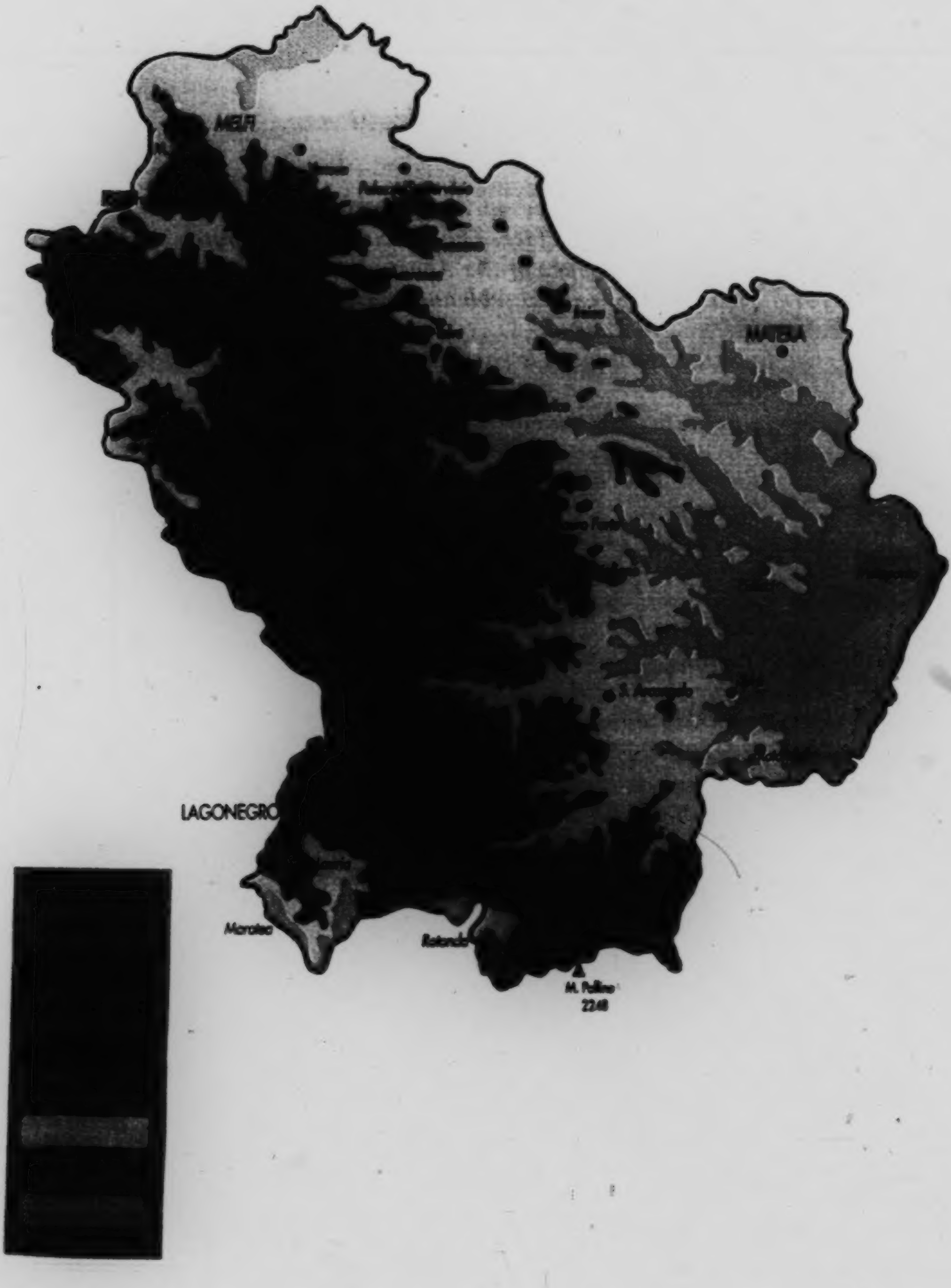
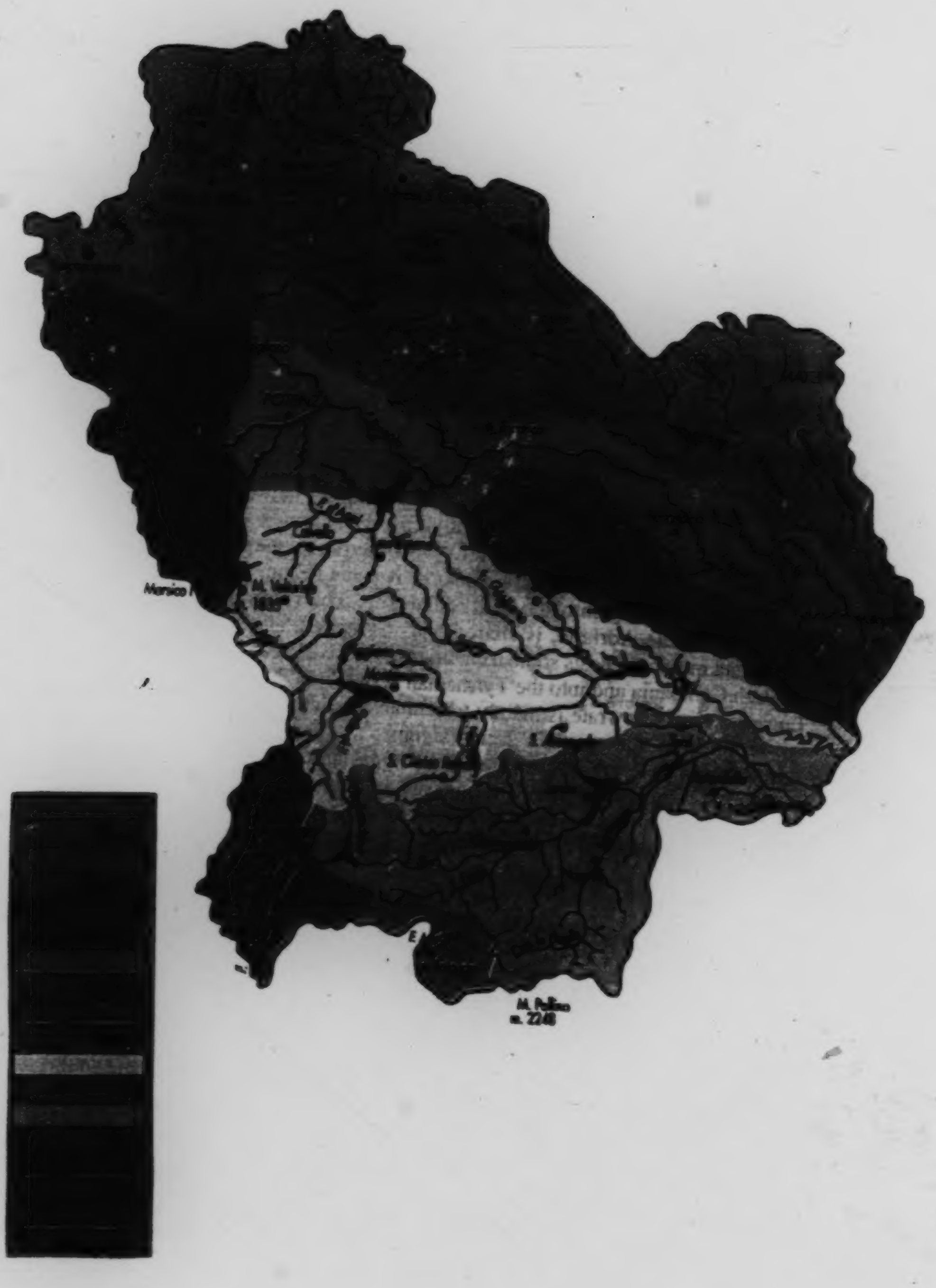

MELFI
MATERA
LAGONEGRO
Maratea
Rotonda
M. Pollino
2248

Figure 4: Basilicata Catchment Areas. Adapted from Basilicata (1993:26).


Marsico
M. Pollino
m. 2248

held to be constants between communities. Rather, it is different geographical location which forms the basis of comparison. Since "[e]levation, distance from the sea and aspect considerably modify the climate over sometimes quite short horizontal distances" in the Mediterranean basin (Boyce et al. 1991:252), variation within each vertical gradient provides the primary data for a comparison between gradients. Micro-environmental variation within a relatively narrow geographical range allows for comparison within a single valley. For example, farms restricted to the valley bottom (plain) are compared with those that are restricted to another identifiable zone, and/or those that may encompass more than one zone within that vertical gradient. This gradient analysis is designed to determine whether micro-environmental differences affect the basic infrastructure of dryland farming, varying according to "how populations and communities are arranged within a given geographical region or area of landscape" (Odum 1983:429).

As is the case for most ethnographic research projects, decisions about the quantity and worth of expanding or reducing data collection were reformulated in the field. Oppido Lucano remained the central research site throughout the course of the research project. Initial data collection, based upon two primary sites incorporating also botanical and faunal data from these areas and from the nearby drier and lower sites from Monte Irsi (province of Matera, Basilicata Region) and Gravina di Botromagno in Apulia, changed after the first eight months of fieldwork. Interview results at that point revealed more similarities than differences. Consequently, I decided to expand the comparison incorporating not only other nearby communities with differing territories, but also communities in zones with divergent local climates. The more mountainous communities of Anzi, Abriola and Calvello south of Potenza at higher elevations (greater precipitation and a more extreme winter) were contrasted with communities near Irsina and as far away as Minervino Murge in Apulia. In the Oppido area itself, extensive interviews were undertake in Cancellara, Vaglio and Tolve (see Figures 1-3). By expanding the geographical area, I was able to refine comparisons of agro-pastoral relations and biological elements which are integrated through practises grounded in local ecological knowledge.

The following table presents basic information for each of the communities studied. The precipitation data is based upon a sixty year average. Some data are missing because no weather station was maintained in the community. The elevations a.s.l. refer to the position of the measuring station. Elevations are approximated in the absence of a measuring station, and are based upon community altitudes as they appear on the maps used (I.G.M. 1960). The Minervino Murge precipitation record extends from 1922-1983, also representative of a sixty year average, but with three missing years (1921, 1958, 1959). The data are detailed in Appendix C.

Table 1: Research sites, elevation, annual precipitation[13]

COMMUNITY @ m a.s.l.*	**METRES** **a.s.l.** (Station)	**PRECIPITATION** **Annual average** **1921-1980**
Abriola (957 m)	No station	No station
Anzi (1008 m)	1066 m	704 mm
Avigliano (800 m)	c. 900 m	992 mm
Bella (662 m)	*c.* 660 m	996 mm (6 year average)
Calvello (795 m)	700 m	981 mm
Cancellara (689 m)	620 m	700 mm
Irsina (445 m)	549 m	599 mm
Minervino Murge (549 m)	445 m	596 mm **
Oppido Lucano (670 m)	650 m	739 mm
Ruoti (751 m)	*c.* 750 m	690 mm (4 year average)
San Cataldo di Bella (900 m)	No station	No station
Tolve (568 m)	568 m	651 mm
Vaglio di Basilicata (954 m)	933 m	722 mm

Data collection procedures

The research data presented here were collected during fifteen months (March 1994 - May 1995) almost exclusively in the Province of Potenza in the southern Italian Region of Basilicata. A number of interviews in the Province of Matera of the same region were included, as were comparison interviews from the community of Minervino Murge on the western limits of Apulia. Interviews and observations carried out in the Potenza province included Abriola, Anzi, Avigliano, Bella, San Cataldo di Bella (the community closest to the Roman site of S. Giovanni di Ruoti), Cancellara, Calvello, Oppido Lucano, Ruoti, Tolve, and Vaglio di Lucania. In the Province of Matera, interviews were conducted near Irsina. In all, over seventy formal, in-depth interviews were conducted with farmers and *pastori*, the insights from these were validated through innumerable informal interviews and direct observation of practises throughout the field study. Observations were made while accompanying *pastori* and their flocks, participating in the various agricultural activities, and collecting plant and sheep and goat (ovicaprid) faecal pellet samples. Other information was gathered from government researchers at institutes in the area, from forestry workers, veterinarians, members of the local farming consortium and agricultural organizations, and university plant and animal sciences faculty engaged in research in Basilicata.

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[13] Please refer to Chapter 3 for a discussion of the value of annual precipitation averages. ‘*’ “m a.s.l.” refers to metres above sea level, hereinafter referred to as ‘m a.s.l.’. ‘**’1951-1994 data, see Appendix C.

I am fortunate that my first language is Italian, for I did not have difficulties in comprehending, speaking and reading Italian. Although I was also familiar with the Basilicatan dialect, during the first two months of field research I had to learn the subtleties of the local dialect with which I became more comfortable as time passed (my use of dialect was appreciated, and my accent was a constant source of amusement). Initially, I did have difficulty in understanding the dialect and being understood by informants who spoke only dialect. However, these first informants were drawn entirely from Oppido Lucano and I returned to speak to them all at various points during my stay. As was the case with many of the early interviews, I returned to ask questions pertaining to new information elicited from other informants. In this way I was able to check the information provided during previous interviews and collect new data.

> In field research . . ., we are heavily reliant on the integrity of the researcher in terms of detailing the nature and quantity of observations and interviews, the process of interpreting the data, and the selections made in the report (Punch 1986:15).

Throughout the analysis that follows, while insuring informant anonymity, I have attributed information gathered to the source community, age and profession of the informant. I have altered reported details where informant identity might be apparent to other community members. I am confident that the information imparted to me, and expounded upon here, is an accurate translation. A significant proportion of the literature relevant to the topic is in Italian and French, both are languages with which I am comfortable, and again, I am confident that the translations I have made are accurate. I am less conversant in Spanish and German. Consequently, I checked my interpretation of the literature in these languages with Spanish and German speaking colleagues.[14]

These data are grounded in and validated by ethnographic, historic, and relevant publications in other fields. Of particular interest to this study are the ancient texts of the Classical agronomists, among which are those of Cato, Pliny, Virgil, Columella, and Theophrastus. As members of the elite propertied classes, despite their evident biases towards the *latifundia* or large land holdings, they discuss technologies for which clear parallels with current, traditional practises exist. Information from these sources shall be included where it is relevant.

Interviews were conducted in a variety of settings -- in informants' homes, in the barns during milking, in the course of grazing flocks, in public areas such as social clubs, coffee bars, and *piazze* (public squares). Upon arriving in the communities, I sought information regarding appropriate informants at the central coffee bar or in the *piazza* itself. Experience led me to ask informants for the names of other suitable informants both within their community and in neighbouring communities. These recommendations allowed me to introduce myself to potential new informants as a researcher who had already interviewed a friend or acquaintance. Where word of my studies and goals had not preceded me, an initial visit to introduce myself and provide a brief oral description of my research goals, in addition to a one page synopsis of my study and letter of introduction helped to ease concerns of potential informants about my role and questions. This initial preparatory visit also gave the potential informant an opportunity to check up on me with the person who had recommended them.

It was clear from the start that my presence might be misconstrued: that I might be a government inspector checking actual numbers of animals and the amount of land sown to wheat. In Basilicata both animal husbandry and wheat cultivation are subsidized through the Common Market agricultural incentive programs. It is common practise to claim more hectares of wheat than actually sown, and greater numbers of sheep and goats in order to claim larger subsidies. Local informants, agricultural organization employees, government workers, veterinarians and animal scientists at the university, commented on this practise and on the unreliability of government statistics.[15]

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[14] I take full responsibility for any inaccuracies in translation. Where informants are quoted, I have included their Italian or dialect words. The dialect is transcribed phonetically according to Italian rules of pronunciation, but does not follow a formalized (i.e., linguistic) system.

Because of this,[16] I learned to ask only for approximate numbers of animals in flocks and estimated numbers of hectares sown to particular cereals. Even so informants hesitated to provide me with numbers, in all likelihood out of a fear that my records would fall into the hands of government agencies -- my protestations of informant anonymity only went so far to assuage these fears. In a few cases, informants vastly under represented the number of animals held, possibly out of fear of thieves. One informant initially challenged me to deny that I was part of a sheep-rustling gang, a preposterous claim until I was told that one informant had been robbed of his flock a week following my interview with him. Another informant insisted that I had been sent by the European Community to investigate the effect of subsidies on flock well-being. In another community I had difficulty gathering any sort of statistical information, and my maps and papers brought out fears that I might be trying to divest someone of their property. Despite initial reservations on the part of a number of informants, all interviews were completed successfully. In general, I had little difficulty in collecting basic data. At each point, I made sure to explain why such information was important, and that "estimates" were all that was required. Whenever possible, I would conduct the interview and go with the *pastore* to graze the flocks. Often, this meant a third day with the *pastore*. Occasionally, a fourth was necessary to clarify data already collected, or to ask a number of new questions which had arisen since the interview. Most interviews involved just two visits, others required several.

On a more mundane level, being a woman alone in a south Italian town provided a challenge in community acceptance.[17] That I would strike out alone was considered dangerous and morally questionable. However, that I was seen to photograph and collect plants and go on rounds to local sheep and goat folds to collect faecal pellets did much to establish my reputation as a 'scientist'. More problematic was the fact that I would spend entire days alone with men (*pastori*), away from the town and watchful eyes of its residents. I was initially without a vehicle and in retrospect, this was fortuitous because it restricted my interviews to *pastori* within an eight kilometre radius of Oppido Lucano. I rapidly learned that my movements and behaviour were monitored carefully. Upon arriving in Oppido Lucano, I introduced myself to the local authorities and explained the study I intended to undertake and provided copies of my research proposal and letters of introduction. At the same time, my self-introductions to many community residents spread news of my project. I made every effort to avoid negative gossip by not going out in the evenings unless in the company of a family or married women of impeccable reputations. As a result, I was able to establish myself as a *persona per bene* (an honourable person). This reputation served me well as I entered other communities. Through the kindness of friends made during this initial period, I had access to two cars which enabled me to extend my research to the other communities once I had discovered the limitations of public transport. My obvious delight in the local foods and wine proffered to me in the many households to which I was invited, my participation in all the community events and evident enjoyment in lending a hand during the various harvests of grapes, almonds, olives, and household production of tomato sauce, sausages and wine provided untold amusement and reciprocal delight in my hosts, not to mention the hilarity engendered by my use of the local dialect. All of these factors, contributed to make this research possible and mitigated against the otherwise unacceptable role of a lone woman researcher working predominantly with men.

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[15] I asked a number of individuals working in official capacities about the value of the information presented in the national census reports (ISTAT 1991). They maintained an accuracy of approximately 65% or less. My experience here is not unique. Other anthropologists conducting research in Sardinia, for instance, have made reference to the problem of using government statistics and collecting their own (Vargas-Cetina 1993:71-85; Ayora-Diaz 1993:41, 64-67; see also Bonanno 1987, Galt 1991a:221 for a discussion of pensions). However, "[i]t is important to note that, contrary to what most Italians believe, Sardinia and the rest of southern Italy are not the most subsidised regions of the country. Rather, the north receives the largest subsidies . . . " (Vargas - Cetina 1993:45).

[16] I had intended to investigate the range of informal economic activities, but I abandoned any formal attempt to do so because of the potential danger to myself and to informants. I also found that the municipality was not disposed to make its records available. Given the peripheral value of these to my project, I did not press this matter.

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[17] This is a problem discussed also by Maureen Giovannini (1986) in her article, "Female anthropologist and male informant: Gender conflict in a Sicilian town."

THEORETICAL CONSIDERATIONS

Humans and Nature

> Biologists' understanding of nature is admittedly a cultural construction, but the anthropological/archaeological view is a cultural construction of biology's cultural construction (Blumler 1996:38).

Study design and data analysis are derived from a number of theoretical considerations. Central to the development of this project is a critique of the persistence of an ideological separation of humans from "Nature".[18] This Cartesian and Judeo-Christian (linear, progressionist-evolutionist) construct underlies research in which humans are perceived to be destructive agents of ecosystems, disrupting an Eden-like "natural" state of harmony and equilibrium (Blumler 1996:26-27; Lewontin 1991; Pálsson 1996; Hoopes 1996). The ideological separation of humans and what is considered "natural" is explicit in Shetler's (1991) discussion of the effect of humans on the America's:

> Two faces of Eden, two kinds of nature. In one direction is the First Eden, nature primeval, pristine; in the other, the Second Eden, nature modified, disturbed, and despoiled. The first nature is natural, the second, unnatural, not because of human presence but because of human domination and destruction. . . . . Consider America's First Eden. . . . . It was not an empty and uninhabited land nor one untouched by human activity. The first seed for the Second Eden was sown, in fact, when the first human walked across the Bering land bridge and set foot in what is present-day Alaska. In some infinitesimally small way, the unnaturalizing of the American wilderness began at that moment. But, measured by our world five hundred years later, pre-Columbian America was still the first Eden, a pristine natural kingdom. The native people were transparent in the landscape, living as natural elements of the ecosphere. Their world, the New World of Columbus, was a world of barely perceptible human disturbance (Shetler 1991:227-228).

Shetler's assertions illustrate the relationship between an ideological separation of humans from nature, an assumed equilibrium state enjoyed by a human-absent Eden, and a construction of indigenous peoples as "natural", "transparent in the landscape."[19] These cultural constructions pervade ecological studies in which humans are cast typically as acting upon a subject, passive environment, not within, nor affected by that same environment.[20]

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[18] Spoehr (1956) discusses this longstanding, but little-challenged ideology, a challenge which has only come under scrutiny more broadly in a plethora of fields (e.g. Crumley, ed. 1994; Bennett and Chaloupka 1993).

Ecologists tend to treat human activity as extraneous, separate from the functioning of an ecosystem, which not only reflects an ideological bias but may also result from the perception that should humans be included within ecosystems analysis, the supposed objectivity of their science would be undermined (Spooner 1987:59). However, like Lewontin, Spooner also proposes that ecological reality is relative, not absolute: "it is relative to the social and cultural experience of the scientist. . . . Our ecological values are to a large extent a function of our social values" (1987:60). In other words, removing humans from ecological studies does not remove subjective biases. Instead, it must be recognized that ecology and science in general are social, cultural and political products (Foucault 1984; Wolf 1982:10-11). It is this ideological "baggage" which defines the approach to and focus of research. However, in recognizing the "Eden fallacy" -- that there is no "original Natural state", but rather, a series of constant changes in a non-linear, non-orderly fashion -- I attempt to avoid imposing such cultural constructions in my interpretations of the data presented here. The ideological (theoretical) alienation of humans from other species and their environment, colours the way we analyse data and establishes humans as destructive agents. In commenting on the "save the environment" ideology, Lewontin notes it assumes that

> there is such a thing as the balance of nature, that everything is in a

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[19] This is an untenable view, especially given recent evidence for massive prehistoric environmental disruption by indigenous human populations (Butzer 1995:20-22; O'Hara et al. 1993; Butzer 1993; Butzer and Butzer 1995; Hoopes 1996; see also Fienup-Riordan 1990:167-191). A significant body of research has demonstrated that foraging groups worldwide affect their environment profoundly, managing and maintaining constructed landscapes both historically and prehistorically (e.g. Lewis 1985, 1989a, 1989b, 1991a, 1991b, 1992; Pyne 1982, 1993). For an extensive overview of studies pertaining to the varied Native American management strategies of mediterranean environments in California, see Blackburn and Anderson (1993).

[20] Systems analysis is of use to me here because it locates humans within the environment, as part of environmental processes rather than external to them. Rather than considering humans as subject to (in opposition to) environmental processes alone, systems analysis shifts the focus of research to how human activities create their environments.

> balance and harmony that is being destroyed only by the foolishness and greed of human beings.
>
> There is nothing in our knowledge of the world to suggest that there is any particular balance or harmony . . . . The environment has never existed and there has never been balance or harmony. Fully 99.999 percent of all species that have ever existed are already extinct (1991:93).

This form of ideological separation is distinct from that applied in systems analysis which involves a conscious selection of some variables and exclusion of others for the purpose of analysis (discussed further below).

Botkin (1990) has addressed the lag between current ecological theory and its adoption by other fields, ". . . that ideas such as ecological climax and equilibrium are based less on how the natural world operates than on outmoded metaphors inherited from eighteenth-century romantics and New World Thoreauvians" (Dobbs 1992:46; see also Dizard 1993). Blumler (1996) expresses the same criticism in light of anthropologists' continued application of dated theories in ecology, among which are assumed stable, "natural" successions to climax communities, and equilibrium models (such as Margalef's 1968 and Odum 1983). Ingerson (1994) too has coined the term "ecoethnocentric romanticism" to counter the presumption ". . . that the Industrial Revolution was the original environmental sin . . ." (1994:54). Equilibrium models have been replaced by models that argue against a balance of nature (i.e., non-equilibrium models; see also Lewontin 1991, above) and for pervasive disturbance even in the absence of humans (Blumler 1996:28-30). Blumler (1996) suggests instead that "a metaphor for nature more in line with current ecological theory would be a kaleidoscope, within which humans are enmeshed and have diffuse and often conflicting impacts" (1996:30). In keeping with the new ecology, I seek to apply Lewontin's analytical framework for the interactions of organisms within their environment.

> [T]here is no 'environment' in some independent and abstract sense. Just as there is no organism without an environment there is no environment without an organism. Organisms do not experience environments. They create them. They construct their own environments out of the bits and pieces of the physical and biological world and they do so by their own activities (1991:83).

> Every organism is in a constant process of changing the world in which it lives by taking up materials and putting out others. Every act of consumption is also an act of production. And every act of production is an act of consumption. . . . A consequence of the universality of environmental change induced by the life activity of organisms is that

> every organism is both producing and destroying the conditions of its existence. . . . So, we must put away the notion that out there is a constant and fixed world that human beings alone are disturbing and destroying. We are certainly changing it, as all organisms do, and we certainly have a power that other organisms do not have, both to change the world extremely rapidly and, by wilful activity, to change the world in various ways that we may think as beneficial. Nevertheless, we cannot live without changing the environment (Lewontin 1991:89).

The dialectical interaction between humans and environments, of reciprocal response and adaptation proposed by Lewontin (1991), bears strong parallels to Crumley's recent (1994b:9) manifesto for historical ecology, to ". . . [trace] the ongoing dialectical relations between human acts and acts of nature made manifest in the landscape." In order to comprehend the relationships between current (synchronic) elements of extant systems, a diachronic (historical) approach is required (Winterhalder 1994:40).

Finally, biological relationships identified in this study are considered in light of coevolutionary processes. Blumler's (1996) caution against an ". . . overly Lamarckian view of vegetation and overly dualistic understanding of human - nature interactions" (1996:31) is relevant here. This is an extremely important point in any analysis of plant-plant/plant-animal relationships which concludes coevolution resulting in, for instance, symbiotic or parasitic mutualisms. Blumler adds that ". . . it is much more characteristic for coevolutionary interactions to be diffuse, complex, involve many species, and incorporate both positive (mutualistic) and negative (parasitic or amensal[21]) components" (1996:35). My analysis here is restricted necessarily to a limited number of species. The relationships which are products of human management practises are neither inherently "good" nor "bad", and may, *ab initio* have been fortuitous associations, but ones which were recognized and opportunistically encouraged, maintained by the local human populations, and transferred in colonizing other areas.

Farming Systems Theory

Analysis of farming systems is based on a holistic integration of social, economic, ecological, political and technological elements of a "system" (Turner and Brush 1988:3; Tow 1991:24). It ". . . presupposes the ordering of the great number of phenomena which can be observed in a given rural area into entities which are meaningful in terms of development, and these entities are systems, i.e. sets of related elements" (Ruthenberg 1976:42). In analysing farming systems, components are identified as relating to and interacting with one another in "sub-systems" (Abou Akkada 1990:165). A single farm system is composed of humans, soils, vegetation, livestock, machinery and so on. Each of these is assumed to have a distinguishable boundary. Ruthenberg (1976) defines the boundaries of a farm unit and hence a farm system as all land "used wholly or partly for agricultural purposes" (1976:44). Soil micro-organisms in this analytical framework are viewed as a "sub-system of the soil system. The soil system again is a sub-system of the crop-producing system and the crop system is again a sub-system of the farm system" (Ruthenberg 1976:42-43). Farming systems on the other hand, are defined as "similarly structured farms" which can be broken down according to types of farming (Ruthenberg 1976:43). This research is geared ultimately to identify farming systems rather than farm systems. However, a comparison cannot be undertaken without first studying individual farm systems.

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[21] Amensalistic relationships are those characterised by negative effects to individuals of one species while little to no negative effect is accrued to the other species in the relationship (Thompson 1982:52-53).

A number of theoretical constraints reside in systems theory. Foremost, it is important to keep in mind that identifying a system is an exercise in revealing relationships between elements. Systems analysis is therefore a tool, while a system is the sum of perceived relationships rather than an entity in and of itself. "All versions of systems theory are concerned with interdependence, regular processes and predictability of outcomes" (Bennett 1976:21). I investigate the methods applied to achieve the agricultural and pastoral goals identified by informants. The authors cited below set out the sorts of interrelationships that are examined. To this end, my analyses incorporate technologies applied in animal husbandry.

> The technology to achieve these goals provides the link between the human, environmental and genetic subsystems to the farming system. . . . The technology for managing soil nutrients includes site selection, clearing, burning, tillage, slope modification, and the application of supplements. Soil nutrients are also managed by the selection of crops and crop mixes and by crop and field rotations (Turner and Brush 1987:20-21).

> In farming systems research, the system concept is used in its broadest sense -- a set of interrelated components and their attributes in which the changes in any component or attribute effect changes in the others. . . . it is a heuristic concept that draws attention to the descriptions of relations among what may be perceived as disparate elements, and to analysis of how the system works (Turner and Brush 1987:27).

Difficulties in isolating farming from pastoralism become evident from the following discussion. Individual farm systems and animal husbandry systems form the analytical units. In fact, these overlap in configurations which shift continuously.

A similar problem identified in setting out analytical boundaries is apparent in theoretical literature pertaining to agro-ecology and grazing systems. Agro-ecosystems are commonly categorized on the basis of cropping systems: dry or irrigated farming, crop as opposed to animal husbandry, and perennial crop as opposed to annual crop systems (Altieri 1987). Intuitively, such categories are untenable because most farm systems incorporate several of these. In southern Italy, perennial crops such as grape vines, artichokes, and olives are part of almost every farm system where annual crops such as cereals are for the most part (but not exclusively) dry farmed, and extensive vegetable gardens *(orti)* are irrigated. Most are also mixed farms and incorporate animal husbandry with cereal production. Therefore, general descriptive categories are of limited value when examining farm systems. They are artificial, analytical tools which generalize dominant patterns to the point of abstraction, but do not reflect on-farm variability (see Turner and Brush 1987:26-27). Agro-ecological research can also be approached from other directions emphasizing such variables as land tenure patterns, the organization of labour, capital and markets (socio-economic), or the physical geography such as climate and soils (Altieri 1987:30-32). This study incorporates something of all of these approaches, but is concerned primarily with ". . . the ecological relations in the field . . . the form, dynamics and function of these relations" (Hecht 1987:5). Further, I employ Crumley's (1994b:12; 1994c:186) analysis of systems as "heterarchies" rather than hierarchies. A heterarchy is ". . . a system in which elements are unranked relative to one another or ranked in a variety of ways depending on conditions" (Crumley 1994c:186). In avoiding a static ranking elements in a fixed order of dominance, the "heterarchical" view allows for an analysis of system flexibility and response to perturbations.

Grazing systems research is also plagued with interpretive problems. Most analyses of grazing systems seek to place their data in generalized categories such as transhumant, nomadic (e.g. Boyazoglu and Flamant 1990), "very extensive" systems (Wilson 1982), or "extensive" (Cunningham 1982), sedentary "intensive grassland" (Coop 1982), "intensive arable" (Newton 1982), and "very intensive" (Ørskov 1982) systems. Whereas the problem does not typically rest in defining an individual productive unit as predominantly one system or another, the difficulty arises in the variability between producers within the same community. These categories are less meaningful than the individual strategies chosen and resources used within a system. These issues shall be investigated in the study while discussing the broad range of systems and grazing, fodder and feed resources.

Another theoretical problem arising from systems analysis is that it requires boundaries be established. Ruthenberg (1976:44) asserts that "any system is bounded by a 'boundary', which separates the system from the environment." What is identified as part of a bounded system, and what exists beyond, in the system's "environment", are variables consciously selected-out of the analysis. Clearly, considering any 'unit' as separate and distinct from any other is artificial (Turner and Brush 1987:27). However, to identify a research problem requires that units of analysis (the delineation of boundaries) are established, and in the case of systems, these boundaries are defined by the relative presence or absence of interactions between system components (Anderson and White 1991:17-18). Therefore, boundaries are determined both by the research problem and presence of interactions between components that define a system (the systemic relations) as separate from other factors (the setting or "environment"). In this study, informants themselves identify system boundaries. Their perception and management of components and component interactions are the criteria used to identify and define systemic relations. Initially, I believed it possible to limit the study areas to a portion of the valleys, which would include their respective vertical geographical gradients and might be based upon a catchment area. However, I found that discrete geographical boundaries could not be established without distorting the data. Consequently, I include here all areas comprised in the day to day, season to season activities of the farming or herding household: a geographical area delimited by the farmer or *pastore*.

Local Knowledge

Variously referred to as indigenous knowledge, traditional ecological knowledge, folk ecology, and traditional environmental knowledge, local knowledge is defined typically in opposition to the western scientific tradition, and is validated only where it is congruent with, or intelligible through, the lens of the western scientific tradition.[22]

In a recent publication, Martha Johnson (1992:7-8) lists a number of characteristics applied to define traditional knowledge among which are: it is an oral tradition acquired through practise and observation, it is holistic, intuitive, socially integrated, and diachronic in nature. All of these characteristics are defined in opposition to "Western Science" (see also Stevenson 1996:288): a futile and misleading exercise according to Agrawal (1995), and one which creates a false dichotomy:

> The classification into indigenous and Western knowledge fails not only because there are similarities across these categories and differences within them. The attempt founders at another, more fundamental, level as well. It seeks to separate and fix in time and place (i.e., separate as independent and fix as stationary and unchanging) knowledge systems that can never be so separated or fixed (Agrawal 1995).

A preferable definition is "any systematic corpus of knowledge which has been derived through experience, transmitted between generations, and which while empirically based and often accurate, is not collected, organized or tested within a formal (i.e., western) scientific paradigm" (Hickey et al. 1992). This definition clearly distinguishes traditional or indigenous knowledge from that presented as "Science." Both 'indigenous knowledge' and 'traditional ecological knowledge' refer to the same phenomena, although 'traditional ecological knowledge' is narrower in scope, focussing on environmental relationships.[23]

That "indigenous" or "traditional" implies a static and culturally bounded system, owes much to a-historical analyses in anthropology (Dirks 1994:3 in Agrawal 1995; Wolf 1982:10-11; 1988). Evolutionist ideology and the perception of indigenous peoples as "close to 'Nature'" has meant that trade, experimentation and change are ignored because any consideration of these historical economic and political variables confounds treatment of groups as a 'pristine', bounded group.

> In the dictionary sense, "traditional usually refers to cultural continuity transmitted in the form of social attitudes, beliefs, principles and conventions of behaviour and practice derived from historical experience. However, societies change

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[22] This privileging of western science parallels the problems associated with the legitimation of oral histories as historical texts only where their veracity is testable against written historical or archaeological evidence (e.g. Cruikshank 1981).

[23] For instance, Shipek (1989) writes of "complex ecological knowledge acquired through long-term experimentation."

> through time, constantly adopting new practices and technologies, making it difficult to define just how much and what kind of change would affect the labelling of practices as "traditional" (Berkes 1992 in Johnson 1992:4).

Research in "indigenous", "traditional" knowledge also arises out of the "development" tradition, a context in which conflict between different systems of knowledge is readily apparent. Hobart (1993) provides an illustration based on the experience of Mexican farmers which can be easily applied to South Italian relationships of government "development" agency and small farmers[24]:

> The [Mexican] farmers' 'underdevelopment' consisted in part of their producing what was not officially recognized, and by unapproved means. The difficulties also involved incompatibilities of knowledge in practice. The dictates of scientific agronomy militate against the crop rotation preferred by farmers, based on their experience of land conditions, in favour of the intensive use of pesticides and other chemicals in order to maximize in the long run (Hobart 1993:15).[25]

In the western scientific tradition, research problems are divided into discrete units for analysis. Data is collected in this fragmented, decontextualized manner for broader application outside of that system. This is an important criticism of the current fashion to "collect traditional knowledge" which preserves (in the museum sense) and suspends knowledge out of context while, at the same time, suppressing change -- what Agrawal (1995) terms *ex-situ* conservation. I prefer Hobart's (1993) definition of knowledge "not as some abstract conceptual system, but as situated practices"; it is "a practical, situated activity, constituted by a past, but changing history of practices" (1993:4, 17).[26] This resolves Berkes' (1992, above) criticism of the use of and implied stasis of "traditional knowledge" and situates inquiry upon the local interrelationships which form the focus of this study.

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[24] The term "small farmer" is used throughout this dissertation rather than "peasant", following upon Polly Hill's (1986) criticisms of the uncritical application of this label by development economists (the focus of her research), and because "peasant" carries with it a whole series of implications which obscure economic diversity between small-scale farming households. In questioning the use of the term "peasant" as a descriptive category, Hill argues that it implies a number of characteristics which cannot be considered universals. "Peasant" as it is generally applied, intimates that the vast majority of labour in farm production is undertaken by household members; it suggests that the farm production unit is largely self-sufficient; and that farm production is the sole focus of "peasant" economic activities.

> The fact is that, wherever one looks, the various expressions of economic inequality within a rural community are almost always certain to render peasant an incongruous word if applied to all householders, however elaborately it may be qualified (Hill 1986:13).

Hill goes on to argue that in placing small farmers (her preferred term) into various categories of "peasants," not only are inequalities within those categories ignored, but a vast range of highly significant economic activities undertaken by small-scale farmers are excluded from analysis. Ever-present inequalities between farm households, Hill notes, affect their economic behaviour and motivations. These differences render generalizations meaningful only if they are applied to the community as a whole, rather than the households they purport to represent (Hill 1986:70-71; see also Blim 1990:82 re: inequalities among sharecroppers in central Italy).

[25] Arguably, "short run" applies equally.

Lastly, efforts have been made to address some of the problematic assumptions by resorting to different analytical perspectives. An example of such a novel approach to examining local knowledge systems is described by Paul Richards' (1993) who proposes that agricultural practise be analysed as performance. His rationale for rejecting the "local knowledge" concept and justification for proposing an alternative analysis, returns us to the problem of analysing local knowledge as bounded, static systems.

> It is a characteristic feature of the oneness of the modern world that indigenous cultivation should have come to be thought of as grounded in local knowledge. To the technologically-minded improvers this local knowledge is often or mainly outmoded, and something to be replaced. Anthropological romantics, by contrast, in establishing their credentials as priests of humanistic plurality, are apt to celebrate it. Both groups are thereby liable to credit local knowledge of agriculture with a spurious epistemic independence, as if were the regular outcome of a process of 'peasant intellectualism' parallel in some way to the processes of intellectualism operating in North American or European academic life. . . . .
> What I try to suggest . . . is that much of the material that gets woven by the anthropologist (or other observer) into a satisfyingly complete, free-standing 'indigenous agricultural knowledge system' is often nothing of the sort, but rather the product of a set of improvisational capacities called forth by the needs of the moment" (Richards 1993:61-62).

In his challenge to current analyses, Richards describes how intercropping decisions are based not upon "a combinatorial logic", but are instead grounded in choices of "sequential adjustment" (Richards 1993:66-68), what might otherwise be considered a risk aversion tactic. In the place of knowledge systems research which he views as mere classifications of crops, farming schedules and rotations, Richards advocates using the performance of agriculture as the lens through which one should analyse farming systems. I argue that the problems he identifies are easily resolved by the researcher asking informants why and under what circumstances particular practises are undertaken. I argue that "improvisations" rarely arise as individual innovations, but are informed by the same experience and practises that constitute local knowledge.

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[26] An alternative view is presented by Gunn (1994) who defines such knowledge as "collective", packaged knowledge which has been "captured" by humans through direct experience, encoded and transmitted through culture from one generation to the next.

I have described at length the tendency for local knowledge systems to be modelled as static not only because the data collected here is analysed as local knowledge, but also because these criticisms have arisen in the discourse of archaeology and ethnography. Danforth (1984:53) notes that in their analyses of modern Greek culture, investigators commonly draw from the cultural evolutionist paradigm by identifying ". . . certain elements of modern Greek culture as fossilized relics of ancient Greek culture", such that "it reduces the contemporary culture of the people to an exotic anachronism." This is clearly true of much of the early ethnography of south Italy (e.g. de Martino 1959; Banfield 1958) and continues to pervade popular culture in Italy. Nevertheless, I argue that by criticizing research which looks to the past to understand the present and vice-versa, the critics are themselves guilty of assuming evolutionary-type change. Furthermore, in addressing this issue, Danforth's unit of analysis is culture as a whole, rather than the technological practises and systems of production which form the focus of my research. I do not equate for instance, the cultures of ancient Italic tribes with modern Italian groups. Instead, I seek to determine the nature of the interrelationships between productive elements of a subsistence system through time.

Other definitions of traditional (indigenous) knowledge reveal another problematic assumption: that knowledge is culturally-specific. Traditional knowledge is typically defined in terms of "the local knowledge that is unique to a given culture or society -- [which] contrasts with the international knowledge system which is generated through the global network of universities and research institutes" (Warren et al. 1995:xv). Knowledge is interpreted, framed and understood in culturally-specific ways (e.g. Fienup-Riordan 1990:167-191). However, cultures are not static wholes or bounded units (Wolf 1982, 1988). Rather, exchange of ideas (knowledge), of materials, methods, and products is an ongoing process today as much as in the past.

Because of the conceptual problems surrounding the term "traditional knowledge", I prefer to use "local knowledge", defined as a comprehensive and complex body of knowledge, a "complex and sophisticated understanding of local ecosystems" (Lewis 1989a:70), manifested further as the ". . . complex of technological knowledge and practice" which contributes to the very nature of the environment and its maintenance, technology being defined as "knowledge used for practical purposes" (Lewis 1991a:279-280). This knowledge is shared by members of a community and transmitted from one generation to the next. It is based upon cumulative experience: an intimate knowledge of the vastly complex interrelationships between climate, environment, causes and effects -- an understanding of the relationships between management alternatives and the manifold repercussions of those decisions. Technology ("knowledge used for practical purposes" (ibid.)) is expressed in culturally specific contexts and through differing ideologies. However, what interests me here is practise and whether practise varies, whatever the ideology or social-political, larger historical framework. To reiterate the basic goal of this study: I seek to understand how agriculture and pastoralism are integrated in practise through local knowledge, and how the biological components combine and recombine in a particular environment, through time.

CHAPTER 2

THE PERSISTENCE OF SMALL-SCALE AGRO-PASTORALISM: ECONOMIC CONSIDERATIONS

> Tradition is not a synonym for mindless acquiescence, resistance to change, or stubborn backwardness; and any correlation between "traditional societies" and "underdeveloped nations" is largely incidental or periphrastic. Traditional behavior, then, refers to actions taken with conscious reference to the past, usually but not always in terms of positive assessment of the way things are believed to have been in earlier times. Obviously any action not totally determined by genetic or ecological factors involves some reference to the past, and even the most traditional behavior results in outcomes that necessarily occur in the future (Bell 1979:23-24).

The significance of the informal economy

Economics is not the focus of this inquiry. Nevertheless, economic structures are relevant to the persistence of tradition and transmission of local knowledge within small-scale production. The greatest small-scale productive efforts continue to be geared to household and local market consumption. Two important points arise here. First, the primary unit of production is the household where monetary values cannot be assigned to household members' labour (Chayanov 1966; see also Barlett 1980:141).[1] Second, the bulk of this production bypasses the formal economy. A comprehensive definition of informal economies sets out the spectrum of activities that fall under this category as follows:

> economic activities that are unmeasured, unrecorded and, in varying degrees, illegal. They consist of: i) legal production of goods and services concealed to avoid taxes or other charges; ii) production of illegal goods and services; iii) concealed income in kind, which includes the profits of barter; iv) other income opportunities that are illegal in that they evade taxes or in some other way deprive the state of revenue (MacGaffey 1991b:12).

The degree to which households produce outside of the formal economy, and the reasons for this, are important factors in the persistence of tradition within the communities studied.

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[1] Chayanov (1966) demonstrated the how changing structure of household membership shifted both the productive capabilities and needs of a household. Carried through, though, is an assumed consistent family "type". The papers in Saller and Kertzer's (1991) compilation document the changes to and fluctuations in household composition through time -- from multiple-family households, to nuclear-family households. Inheritance and post-marital residence (household structure) in the Basilicata area are discussed below.

In his exploration of the persistence of small farms in Sicily, Bonanno (1987:76) makes only a passing reference to the informal economy despite its estimated growth to equal 25% of the southern Italian GNP. The informal economic activities he identifies for this area range from "cottage or household production to overtly illegal production involving the use of child and/or non-authorized migrant labor" (ibid.). Relevant to the discussion at hand is the former, although the latter, "non-authorized migrant labour", is also present in the area. Bonanno does not pursue the impact of the informal sector in his analysis of the persistence of small farms. He argues throughout his work that small farms are far from economic self-sufficiency, concluding that they serve to absorb otherwise unemployed labour and survive largely through government aid in the form of welfare payments and other social programs. His failure to investigate the contribution of the informal economy to the incomes of the farm households under study, undermines his conclusions. Arguably, production bypassing the formal economy provides significant additional, unrecorded and untaxed income to households and accounts at least in part for the persistence of small farms. Based upon my observations and discussions with farmers and particularly *pastori* in the area studied, the local sale and exchange of produce contributes significantly to the household's economic well-being.

The local economy, the production and informal exchange of goods and services, is a common phenomenon, typical of the Italian South. I agree with Edelsward's (1994:164) assertion that this traditional economy retains its importance and is "still strong today although no longer dominant."[2] Her description of the Sardinian example elucidates the extent and form of these exchanges, representative also of Basilicata.

> [T]he traditional economy of Villagrande . . . may be viewed (from the perspective of tax collectors) as a thriving underground economy. For example,

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[2] The number of persons at the town/village level now employed by the municipal and Regional governments has increased dramatically with the post-WWII growth of infrastructure -- a product of the development funds for the South *(Cassa per il Mezzogiorno)*. However, the dominance of the formal economy is questionable in rural settings. The informal economy, by its nature, is unmeasured, and practically all households are engaged to varying degrees in informal exchanges.

> the shepherd whose milk is sold directly to dairies receive [*sic*] official receipts with which they must account for their income for taxation purposes, but the shepherd whose product is locally produced and sold cheeses -- who may often be the same individual who sells milk directly to the dairy as multiple strategies are typically followed (only one shepherd in Villagrande reported selling 100% of his milk supply to the dairy) -- are outside the official system of accounting, controls and checks. These transactions are informal and personalistic, whether the exchanges are for cash or in kind, as is normal for most village affairs. A large number of small businessmen, especially tradesmen, fall into this category as well (Edelsward 1994:164).

In the face of more than thirfy years of increasing government intervention, most recently evidenced by controls over wheat production through Common Market subsidies regulated at the regional level, the informal, non-market economy has retained its integrity. It is particularly within this sector that tradition is maintained. The authors of a recent article examining the persistence of hunting in James Bay area (Canada) aboriginal communities (George et al. 1995), conclude that hunting has retained much of its past economic importance despite the integration of these communities into the larger, wage-driven Canadian market economy. Their study reveals that hunting continues to contribute significantly to household incomes as part of the subsistence, informal sector, particularly as food. Also suggestive is the importance of hunting to Cree cultural identity (George et al. 1995: 81-82). Similar conclusions arise from an earlier analysis of traditional Dene subsistence which shows subsistence to have a value beyond purely economic, but extending to identity (Asch 1977; see also Smith 1986:63). Despite the different cultural and economic structures, the James Bay study raises two important points: the importance of the informal sector in the local economy and the significance of this traditional subsistence strategy to identity. I argue for these and a third factor: the importance of a maintaining a degree of economic autonomy from the formal (outside) economy by retaining this traditional form of subsistence.

Campanilismo is variously defined as an identification with the village (home town) (Gaetani 1981:165), as "the particularly strong attachment felt by rural Italians to their villages of birth", and as "the unity of everyone who lives within the sound of the village church bell" (the *campana*) (Bell 1979:176, 3). Bell (1979:28-29) suggests that the sentiment of *campanilismo* is born in part of the need to maintain and defend communal rights, particularly common grazing and woods, whereas Maraspini (1968:51) considers it an artifact of the feudal order and the ties of serfs to the land and feudal lord. What interests me more, however, is the role of *campanilismo* in "the unity of village and tradition" (Bell 1979:28). Whichever community I visited, its residents commented on the work ethic of its members and on the superior quality of food and hospitality, to the those of other surrounding communities. On one memorable occasion returning by bus to Oppido Lucano from Potenza (the regional capital), I inadvertently started an argument when I asked a question about the different practises in preparing meat for sausages. The individuals on the bus were from three different communities and the discussion, initially limited to whether the traditional method of cutting by hand was preferable to the use of the quicker and less labour-intensive meat grinder, laid the foundation for a heated debate arguing the merits of sausages made in one town over sausages in another. In my visits to the various towns studied, and my sampling of foods in each, I noted subtle differences in methods of food preparation and condiments that exist even between neighbouring communities. Furthermore, the lack of significant variation between households within the same town was striking. Both suggest a continuity of tradition and homogeneity of practise within each community. The identification of village/town with practise is further supported by the perception, expressed to me by numerous informants, that individuals (typically women) who had married into the community[3] consider themselves, and continue to be perceived by the larger community as outsiders, imbued with different practises and behaviours, regardless of the longevity of their residence in the "adoptive" community.

> In a curious symbiosis of space and person, Italian peasants (and to a lesser extent the rural elite as well) perceived a fundamental distinction between their *paesani*, born within the bell's ring, and *stranieri*, outsiders. *Campanilismo* involves pride in the village and an intimate knowledge of all it contains (Bell 1979:151).
>
> *Campanilismo*, then, is a conserving and preserving force, defined by birth (and therefore by fate), immutable and immune to human intervention, circumscribing the present by the past (Bell 1979:153).

I observed friends, neighbours and kin dropping by during food preparation and other household production. During these frequent visits (almost daily), the visitors commented upon preparation techniques, measurements of ingredients and the appearance of the product, freely providing suggestions and criticisms. These and intra-household exchanges of labour appear to be a means of maintaining a consistency of practise (tradition) between households, and a vehicle through which knowledge is transmitted between generations within a household.[4] On this seemingly casual basis, knowledge is transmitted from one household to the next and between generations, establishing community-wide standardization of practise.

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[3] Village-town endogamy still appears to be the preferred marriage pattern. As numerous informants noted, they know what they are getting when they marry within the town. I was surprised to find this preference expressed also by teenagers today.

It is within this setting that traditional, local knowledge in Basilicata has persisted in rural communities despite the growing numbers no longer directly engaged in year-round farming or pastoralism. Each household in varying measure continues to engage in some aspect of traditional practise (whether vineyard, olive grove, or vegetable garden -- *orto*) and maintains a strong connection to locally produced *"robba genuina"* (authentic goods): cheeses, wines, tomato sauce, wheat and olive oil, for instance, and locally raised chicken, pig, rabbit, kids, lambs and veal (see Edelsward 1994:289-292 for the Sardinian parallel; De Felice 1991:9).[5] The vast majority of households in the area produce their own wine, harvest and have their olives pressed for oil locally, harvest their own tomatoes and bottle their own sauce, butcher pigs raised either by the household, or by another local household for them for sausage, and so on. Where households do not have the means to raise or produce for themselves, they informally contract relatives or other community members to raise/produce for their needs as well, frequently supplying labour in the harvesting of the produce.

I was particularly struck by the great value attached to locally produced goods. Tinned products, packaged pasta, some cheese and deli products, biscuits, vegetables and fruit and so on, are purchased by most households. However, the day to day staples such as bread, the wheat for which is grown and milled locally, all tend to be produced locally. Informants explained that they consume only locally grown or raised foods because they know how they have been produced. Increasingly this has expanded beyond knowing that the animals purchased are healthy and have been well-fed, for example, to the knowledge that the food has not been chemically treated. Suspicion that imported foods have been treated with pesticides, herbicides, or raised with feed supplements, has added value to locally produced foods, while those foods from outside the community are avoided whenever possible.[6]

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[4] That *pasta asciutta* is consumed Tuesday, Thursday and Sundays throughout Oppido Lucano is another example of intra-household consistency of practise.

[5] This is true also for southern Greece. Koster (1977:150-152, 166) reports that regardless of principal occupation, whether barber, shopkeeper, day labourer, etc., households engage to some degree in subsistence production. Furthermore, as in Basilicata, herding households also farm and farmers tend to keep some livestock.

Concern over the quality of produce and the possibility of chemical additives such as pesticides, herbicides and feed supplements, is not the only reason for a strong preference for domestic, local produce. For the day to day staples particularly (such as bread, pasta, olive oil, wine, tomatoes, sausage), informants emphasized the social importance and value of household production of the bulk of these. A great deal of community respect is given to the thrifty household producing its own pasta and bread. Most households keep a few chickens and rabbits, whereas cheese, lamb and kid are for the most part purchased from local *pastori*. The cost of labour involved in production is absorbed by household members, extended family, and/or labour exchanges.[7] The participation of a heterogeneous mix of household members, acquired kin and neighbours, involves the transmission of community-based standard practise, or local knowledge. The high value placed on local, household production outweighs the cost in time and labour (see Edelsward 1994:287-300, 442). Where labour is added, it is typically through reciprocal exchanges, and not bought (see below). Those who depend more on purchased items tend to be households in which members are engaged in full-time wage labour outside the community, and which do not have access to family and friends with sufficient produce to accommodate extra-household needs.

Perhaps the strongest motivating force for the persistence of traditional household production of staples is maintaining a degree of household economic autonomy. The bulk of locally produced goods are locally consumed. The formal economy does not enter into the exchange of household-produced staples, transactions which are generally cash exchanged for goods with no taxable trace.[8] In the Sardinian example, Edelsward remarks that:

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[6] Koster (1977) records a similar concern in his study of agro-pastoral communities in the Peloponnese:

> Weeds such as wild mustard are also collected during hand weeding of the cereal crops, especially wheat. This practise is becoming less common with the increasing use of herbicides to control weeds. It is not that the herbicides are entirely successful in controlling the field weeds, but rather that the people are conscious of the dangers of ingesting these chemicals. It is instructive that although they are willing to use chemical fertilizers freely in the production of their cereal grains, or for market crops, that they use only manure in their kitchen gardens (Koster 1977:359-360).

[7] Household production is based predominantly upon women's labour (see also Meloni 1984:162-183).

> Tax evasion in Villagrande is not entirely, perhaps not even in the greatest part, the deliberate efforts of individuals to delude the state; it also represents the persistence of some aspects of traditional culture in the face of the profound transformations inherent in incorporation to national and international economic and cultural systems, the survival of the informal, the personal and the local . . ." (1994:165).

Also commented upon by Edelsward (1994:103-104), and shared by informants in Basilicata, self-sufficiency is an ideal and a communal goal to be achieved by the household. In the communities studied, avoidance of the formal economy is one facet of the strong, community-wide value placed upon self-sufficiency.

Land and labour

> . . . the owner of a flock who makes use of common grazing lands or rents lands (and lands under other forms of ownership or possession), who grazes his own flock by himself or in common with others who lend labour, or pastures or animals. The owner of the flock can also be an owner of grazing lands, a farmer, working communally, or hiring shepherds, or can be all of these things at the same time (Angioni 1989:19, my translation).

There is "apt to be much overlap between categories, as with farm-labourers who are also owner-cultivators" (Hill 1986:155). This phenomenon has been clearly established by Lewis (1971:119-121) in his investigation of Ilocano Rice Farmers. His study shows that the pattern of farmers working under more than one system of land tenure results from fragmented land-holding in which plots are distributed through inheritance such that owned plots in distant areas become inconvenient to farm. In these instances, owners rent the distant plots to others and, in turn, rent plots closer to those they are farming. While the household renting land can be typed as land-owning, it may simultaneously be renting land from another household and be farming land it owns. A single household's economic status is therefore difficult to measure based solely on land tenure relationships if these are not considered in their entirety. To add yet another level of complexity, in the Basilicata region, owners/cultivators frequently work (for wages or labour exchange) for other cultivators as agricultural labourers.[9] Thus, categorizing households according to a form of land tenure tends to obscure the complexity of household's farming activities and the complexity of economic relationships with other community members.

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[8] On several occasions I heard the warning "be careful, the tax officials are around, don't let them catch you!"

Inheritance in Basilicata is bilateral. Most households own land. Those not engaged directly in farming or pastoralism rent what arable land they have, and generally own smaller plots which they cultivate in vegetables, grape vines, and/or olives. The acquisition of land is a shared goal of all households except childless households. Providing an inheritance for their children, preferably in the form of land, remains the primary goal of parents in the area. This same goal is recognized by Friedl (1967) in her study of "Dowry and inheritance in modern Greece":

> What is considered success? The essential family obligation is to maintain a ratio between property and children such as to enable each child, when the property is divided into substantially equal shares among the children, to maintain in his turn and for his family a decent standard of living.
> The patrimony is transferred to sons by inheritance or by gifts *inter vivos*, and to daughters by dowry (Friedl 1967:57).

In the province of Apulia, Galt (1991c) documents a similar tradition:

> the provisioning of newly forming household enterprises was a central life's purpose for small-proprietor parents. The ideal was to live in and to reproduce households that produced most of their own subsistence needs -- olive oil, cheese, wine, wheat, fava beans, fruit, and a little meat, as well as fibres for weaving. . . . .
> Peasants couples developed strategies about providing for their children, and the reputation of parents greatly depended on how well they accomplished this. . . . . Partible inheritance prevailed. Their eventual inheritances in part formed marital property settlements for both men and women, and the parents of the groom hoped to provide a newly constructed house for the young couple. The ability to "systematize" children obviously was an accurate reflection of parental success at solving the problem of adequately expanding and managing the family patrimony (Galt 1991c:311-312).

Upon marriage, both parental households combine resources to purchase furnishings and other necessary household items. Basilicata women bring into the marriage linens and other essentials to set up their household. The poorest married with very little, perhaps a single set of sheets and an extra nightgown (e.g. Stefanile 1979, 1986). Nevertheless, when families had the means, under the system of bilateral inheritance, women also inherit property from their family, a portion of which may be awarded at marriage, such as part of a vineyard or orchard, or a parcel of arable land.[10] The inheritance provided depends upon the extent of the family's land holdings and the number and gender of offspring. In order to avoid fragmentation and reduction of farm lands beyond the point at which a household can subsist, the bulk of the farm property (in the case of agriculturalists or mixed farmers) is, as a rule, bestowed upon the first son (primogeniture)[11] who is expected to bring his wife after marriage and continue to farm under his father's direction.[12] Some of the older informants explained that under the past, strongly patriarchal structures, obligation to the parent, with or without affection was the rule. Unquestioning obedience to the father who commanded the economic activities and futures of his children was expected, and where property was sufficient, farms were conducted *in società* (communal, multi-family farms) governed by the father.[13]

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[9] The geographical diversity of the area and resulting variation in climates between relatively close communities means that harvesting completed in one zone and has yet to start in another. In the past this meant that workers and owner-cultivators were "free" to hire themselves out in harvesting crews in the cooler regions, and vice versa (see Stefanile 1986:141-153). To some extent this practise continues, but it is the combine-owner who hires his services out to communities with crops maturing at a different time than his.

As in the Greek example, where the family has sufficient means, remaining sons are trained in other professions such as the priesthood (see Friedl 1967). Many families do not have the resources to establish their sons in professions, and once married, the young men strike out on their own. However, a number of cases were brought to my attention in which the sibling receiving the farm property or flock paid out a portion of the earnings to each of the other siblings on an annual basis, a pattern reminiscent of that described by Lewis (1971:88) where land is limited. The returns are insufficient to support the other siblings, but the income from the farm or flock supplements their earnings and helps to avoid animosity among siblings over inheritance. Initiated in the 1860s, large-scale emigration for work was common among the property-poor and it continues today although to a significantly lesser degree. Most informants had worked for a number of years outside their home communities, finding wage labour predominantly in North Italy, Germany, France or Switzerland in order to accumulate capital to purchase a small property, or build a modest home.

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[10] As Silverman (1967) indicates for rural Tuscany, the portion of family (patrimonial) property due a woman is calculated as part of her worth.

[11] This varies depending upon the interests of the sons. In Galt's study of an Apulian town, ultimogeniture predominated (Galt 1991c:314). In several instances among interviewed households, inheritance of flocks and farm properties were based upon the parents' evaluation of which son (and daughter-in-law) would best look after them in their old age. A similar process of selection is described by Goldstein and Bell (1990:56-57) for western Tibetan pastoral nomads.

[12] Post-marital residence is primarily virilocal. In the area, parents who are able to, build apartments above their home for their sons and their families. Children whose parents do not have the resources to build their own home, tend to wait longer to marry, until they have accumulated enough capital to build their own home, or to furnish a rented home. I noted that where available, young couples built their home neolocally on a plot of inherited land.

[13] See Foster's (1967:57) description of Mexican small-farming "joint-families and Douglass (1991). Family fragmentation dissolves pooled land and labour and hence, results in land fragmentation. Although, as families expand in numbers, so does the land become limited unless there is other land available to purchase.

An opportunity arose through which I was allowed to review, only briefly, a number of the individual responses to the latest (1991) agricultural census which required respondents to list the size and locations of their properties.[14] In addition to the answers provided by informants in my own study, the bilateral inheritance system in the area was evident in the census responses. Inheritance properties brought into a marriage by women marrying into the community tend to be in a separate zone from those inherited patrilaterally. Thus, most families have properties scattered over a wide area, and in other townships. As noted above in the Philippine case (Lewis 1971), distant properties are let out because they are awkward to reach. However, some properties are farmed rather than rented even when they are located at a distance from town and from other property.[15] The rationale behind maintaining these scattered properties at various elevations and with different exposures, has important implications for farming and pastoralism in this area and is discussed below (Chapter 3).

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[14] The names on the individual responses were blacked-out on the questionnaires I was shown. Nonetheless, because these are confidential documents and were shown to me in confidence, I could not copy information. A synthesis of the official census results appear in Appendix A.

[15] Renting land is the least remunerative strategy unless rented with an informal agreement to split the cost of seed and the Common Market subsidy payments. Rental rates of agricultural land are kept low by law to benefit active farmers. However, landowners are hard hit because they pay heavy taxes on their land. Taxation levels are based upon the quality of the terrains, and are higher for lands in the more fertile plains than the less fertile, less accessible slopes and mountainous areas. This variable also figures in decisions to rent or work land.

In the course of my fieldwork, I saw that with few exceptions, the labour invested in both pastoral and agricultural households was drawn from the household itself. The exceptions to this rule were large scale enterprises using family labour in addition to a single hired hand. In a couple of cases, flocks were grazed by *pastori* from outside of the region, typically North Africans.[16]

Discussed further below, the historic division between landed and landless in South Italy was extreme. Oppido Lucano was not exceptional. The bulk of local populations worked for low wages for large landowners and lived in agro-towns from which they walked (sometimes taking a few hours) to reach the land to be worked (see for example, Stefanile 1979, 1986). Whereas in Central and North Italy, social divisions between seigniorial classes and agricultural labourers were as distinct as in South Italy, the poverty in the South was more extreme because of poor harvests, droughts and malaria (Silverman 1968; Stefanile 1986, 1979).

Comparaggio: A system of acquired (fictive) kinship

At baptism, a child acquires a *padrino* (godfather) or *madrina* (godmother), bringing the child into a relationship of *comparaggio*[17] or "ritual co-parenthood" (Mintz and Wolf 1950 (1967); Davis 1968:23). The child becomes a *figlioccio* (godson)/*figlioccia* (goddaughter) to their *padrino/madrina*. This widespread system of acquired kinship, a formal dyadic contract,[18] has been well-documented elsewhere (e.g. Foster 1967: 75-85, 212-243). "Theoretically, a *compadrazgo* relationship is a permanent one, and binds its participants together in a relation of deep, publicly recognized, mutual obligation" (Davis 1968:23). In Basilicata, were the biological family to experience such hardship as to render it incapable of feeding or sheltering a child, the *compare (padrino/madrina)* were under obligation to help. *Compari* (godparents) acquired at baptism are also responsible for the proper education of their *"figlioccio/figlioccia"* to insure that the child becomes a moral person. These *madrina/padrino* relationships are known as *"Compari di San Giovanni."* In the past they were of greater importance and were more commonly called upon than they are today given the national social welfare system.[19]

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[16] These exceptions recall past social and economic divisions of the large feudalistic estates in that the labourers tend to be extremely disadvantaged, having no real legal recourse without loss of job and deportation.

[17] In Italian ethnographies, these alliance relationships are also termed *comparatico* relationships (see Angioni 1989:201). The Spanish term, also commonly used in ethnographies, is *compadrazgo*.

[18] The most succinct description of dyadic contracts is set out by Foster (1961):
In the absence of corporate units, contracts can occur only between pairs of individuals; they must be dyadic. In the absence of legal or ritual validation, contracts must be considered informal or implicit. Informal or implicit contracts can be validated and maintained only by means of recognized reciprocal obligations, such as by the continuing exchange of goods and services (Foster 1961:1190).

"In the past, people sought to establish *comparaggio* relationships with those who were richer" (Informant, Oppido Lucano). These vertical, dyadic relationships provided greater benefits to the poorer families (see Chapman 1971:118 for a Sicilian example; Maraspini 1968:200-202 for Apulian examples). Through these acquired kin, the poor could call on the *compari* for favours and "recommendations", generally help with administration, to get the ear of an official, or help in finding work for their *figlioccio/figlioccia*. In Mintz and Wolf's (1950) analysis of the history of these vertical dyadic relationships, they note that

> Under feudal conditions, then, one of the main functions of the compadre relationship was to structure such individual or family relationships vertically between members of different classes (1950 (1967):180).

Vertical *comparaggio* relationships also served to establish ties with the literate individuals within the community, and thus aid in the deciphering of important notices and in the writing of letters. The poor half of the vertical dyad provided labour and produce such as an occasional chicken, a few eggs, cheese, a rabbit, vegetables from their garden or collected spontaneously growing greens to give to the rich *compare*. As such, it has more in common with the patron-client, asymmetric, dyadic contract described by Lewis (1971:119-127), than with a simple landlord-tenant contract.[20]

The choice of *compari* involves other considerations. To choose someone to be a *compare* is to show respect and esteem for that person. Mintz and Wolf (1950) assert that the formalized horizontal dyadic *comparaggio* relationships serve to "solidify social relationships horizontally among members of the same rural neighbourhood" (1967

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[19] An informant also noted that the *padrino* relationship of a *mafia* don is the same -- the don holds important the economic and "moral" well-being of his *"figliocci"*.

[20] The origin of patron-client relationships in Italy, *clientelismo*, is attributed to feudal relationships between landowners and tenant farmers (Jansen and Jansen 1992:26).

(1950):181). In Basilicata, *compari* were chosen from outside the family most commonly. The goals here were to enlarge the kinship network *("allargare la parentela")* or as a demonstration of affection and esteem for a person. This form of acquired kinship thus establishes or reinforces a relationship of mutual respect.

> In the past, these relationships were more commonly established with people outside the kinship network and even outside the community, such as an important friend. Choosing a *compare* is a demonstration of affection which also shows respect to those incorporated into the family in this manner. It is an important choice (Informant, Oppido Lucano).

The same is true for the *cresima*. The *cresima* (Catholic Confirmation) is another religious celebration through which the kinship network is enlarged. The selection of a second set of *compari* is the choice of the young persons undergoing Confirmation, but is generally undertaken with non-kin (particularly in the past) who are important friends of the young person (a horizontal dyadic alliance). Accepting the role and responsibility of a *compare* at Confirmation means accepting the same religious/moral responsibility that is held by the *madrina/padrino* acquired at baptism. This relationship ties both families together as in the baptismal "co-parenthood". It differs only in that the *compari* are of the same generation rather than different generations. Both forms extend networks of mutual aid and obligation, adding to a web of relationships that integrate the households within a community (and beyond) along both horizontal (hierarchical) and vertical (lateral) lines. Koster (1977) arrives at similar conclusions in his study of a southern Greek agro-pastoral community, in which ". . . inter-household networks of mutual obligation play a key role in the economic integration of the village . . ." (Koster 1977:423).

Mutual aid relationships

In addition to household members' labour, small-scale farmers and *pastori* tend to "hire" kinsmen or others with whom social ties have been established (e.g. Wolf 1966:81-89; Lewis 1991c:9, 19-22). This complex social network from which labour might be drawn works outside of wage labour. Typically labour is reciprocated and/or small amounts of farm produce are supplied in exchange for that labour. For instance, Bonanno (1987:173) notes for Sicily, that compensation for farm labour may take the form of "free" food, wine or a small amount of olive oil (household produced) with the expectation that the labour will be reciprocated when needed.[21] With casual labourers, obligations end with the completion of the work project. Labour is not usually bought. Most commonly, labour needs are met through other forms of exchange, based on mutual aid relationships grounded in social networks.

Accepting a favour establishes a relationship of mutual obligation. Favours are not called upon in a vacuum, but occur within pre-existing dyadic relationships. These take a number of forms, from dyadic vertical *comparaggio* relationships to dyadic horizontal ties with *compari* (also acquired through the *cresima*), neighbours, friends, and family (see also Foster 1967:74-85). The exchange of favours is generally balanced, although this varies depending upon the type of dyadic alliance. Each person is born into a network of mutual support and obligation, a family network which is expanded throughout the individual's life. Depending upon the relationship between the parties, the sort of obligations and reciprocity involved varies.

There is equally an expectation of reciprocity within extended families, although not necessarily balanced: each person contributes what they can when they can. For example, through these dyadic, horizontal ties -- Wolf's (1966) dyadic alliances -- a household will provide diesel fuel, the use of their various tractors, combine harvester, and assorted tools to a relative. In exchange, the relative offers his and his son's labour during harvest, and whenever there is a need to help with various odd-jobs on the farm and elsewhere. However, this is not a balanced exchange as it costs the supplying household more than they get in return. Discussed further below, such relationships based upon obligation and less than balanced reciprocity, may result in a cooling of relationships if perceived to be exploitative.

Exchanges within nuclear families are not balanced, but are similarly based upon reciprocal, mutual aid. Although there is no immediate expectation of reciprocity, obligation remains. As with extended kin, each member contributes what they can. The expertise of individuals is called upon to deal with particular emergencies and less immediate problems. For instance, an unmarried son who is skilled at electrical repairs of all sorts, is called upon frequently by his parents and siblings to fix their appliances. Within his family, he can anticipate that should he require help, that his siblings will be ready and willing. Where relationships have not been strained, in a family crisis, all contribute everything they can, knowing that they in turn can expect similar support. Were they not to provide aid, the family would suffer and ultimately, so would they.

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[21] In the recent past, the practise of paying agricultural day-labourers with a litre of olive oil (for one day, for a man) or half litre (for one day, for a woman) for the olive harvest, was true also of Oppido Lucano. The practise of providing meals continues, but where other forms of exchange are not used (below), then labour is paid for in cash. Women agricultural labourers frequently work at a much-reduced wage in exchange for the accreditation of a day's labour in order to qualify for the state agricultural labourers' pension which requires a certain number of days' work per year over a number of years. Traditionally, agricultural labourers' pay was based upon age and gender. Women and boys were paid 2.5 lire/day and men 5 lire/day for such labour as hoeing and weeding.

Exchanges outside the family tend toward a more balanced reciprocity. These exchanges occur through informal dyadic contracts. For instance, one party ("A") will help another ("B") with particular tasks such as grape harvest, vine trimming, olive tree trimming, pig slaughter and butchering during the agricultural year in exchange for "B's" labour and equipment in ploughing, harvesting or haying. "B" benefits by having access to labour during critical periods while "A" benefits from not having to purchase and maintain expensive equipment. Such an arrangement is generally found where "A" has insufficient land to warrant the capital investment involved in purchasing equipment, and occurs outside of the formal economy.[22] This is a valuable relationship for both parties: one party does not pay for farm machinery and fuel, repairs, insurance, and labour, while the other has at his disposal a skilled labourer ready to help during periods of intensive labour. Described further in light of the integration of farming and herding, mutual aid relationships serve to integrate households engaged in different productive activities (see also Koster 1977:423-424 for similarities with Greek communities).

The value of a support network is seen in the amount of effort devoted to maintaining relationships. Within small communities such as Oppido Lucano, and kin-*comparaggio* connections require careful tending because of the many affiliations acquired (also through marriage) in the course of a lifetime. Three ovens and bakeries are supported by the population in Oppido. An individual might have kinship or economic ties with two or all three. In the case of the mill, milling flour for all three bakeries, bread for the household was purchased by the miller at all three in rotation.[23] Many small shops are supported by the population who also purchases groceries from the less expensive supermarket. These small shops are supported by the persons with whom the shop-owning household has ties. An individual might shop at a number of stores to maintain good rapport. I came to understand the value of "spreading" my few lire around the community when local friends suggested strongly that perhaps I should frequent other stores as well as those I had frequented, and went out of their way to remind me to do so. Conflicts arise over the patronizing of one or the other of two restaurants in Oppido for the wedding feasts upon which the restaurants rely. For this reason, wedding feasts frequently are taken to out of town restaurants, while the Oppido restaurants host wedding feasts from other nearby communities.

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[22] For example, a farmer will plough, seed, harvest, level land, etc. for a friend. In exchange, the friend will provide labour to pay this debt such as assisting in hoeing the vineyard, grape harvest and wine production, trimming and tending of vines and fruit trees, and pig slaughter and butchering.

In those instances where kinship or *comparaggio* ties are not present, for instance at the daily market in which vendors come from outside communities, both vendor and client work at establishing, personalized, dyadic vendor-client[24] relationships (Silverman 1968). Establishing an exclusive relationship to buy from a particular vendor benefits both the vendor who maintains a steady, dependable clientele, and the purchaser who is given the better quality produce, the occasional free item and is often served before the less frequent and non-exclusive client. In my own experience and despite the rather meagre purchases I made, merchants and vendors attempted to establish vendor-client relationships with me once news of the longevity of my stay became generally known.

The dyadic mutual support alliances described above, both horizontal and vertical, are carefully maintained, but can fall apart through one party being seen to exploit the other, or by *offesa* (offending) which will end the relationship. I learned of a number of such instances during my stay. Families will distance themselves from members who take, but cannot be counted upon to reciprocate. In a few cases, I learned that relationships had been terminated by an intentional *offesa*, in order to end one-sided, exploitative relationships. The degree of elasticity in a relationship depends upon the closeness of the relationship (closer kin or neighbour-*compari*) and the potential benefits of maintaining the relationships or social cost of terminating them.

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[23] Another example I noted involved the possibility for conflict in the ordering of wedding pastries by a family with familial and *comparaggio* ties at two bakeries. In order to resolve the problem, the family put in a half order at each, thereby avoiding alienating either of the two households running the bakeries.

[24] These personalized vendor-client, dyadic relationships are reminiscent of the "suki" relationships described by Davis (1968) in Filipino markets, except that the Basilicata relationships do not have the extension of credit -- a salient feature of the Filipino relationships.

All behaviour is subject to social comment, and the status of support networks is at the heart of much conversation. The closer the relationship, the more socially costly is its disruption. Divisions within nuclear families and between siblings in their independent households are particularly disruptive. Much friction is smoothed over or tolerated. Nevertheless, even in relationships between close kin bound by friendship and proximity of residence, care must be taken not to distort mutual-aid relationships. Out of these relationships may develop an anticipation of labour contributions during busy periods in the course of the agricultural year. The voluntary aid is not necessarily remunerated or exchanged in these households, but if the contribution persists with no offer of or gesture towards reciprocation, then other members of the family or the community at large will begin to comment upon the lack of reciprocity.

It soon became apparent to me that unwritten, but carefully tended balance sheets are maintained between households. A grown son's labour independently offered by the son to a friend, *compare*, or kinsman, nevertheless is considered a contribution by the household as a whole to another household. There is a tension inherent in these relationships in which participants play upon the elasticity of the system, and on the reluctance to terminate relationships.

Foster (1967:219) writes of these dyadic alliances:

> A very important functional requirement of the system is that *an exactly even balance between two partners never be struck*. . . . . The dyadic contract is effective precisely because partners are never quite sure of their relative positions at a given moment (emphasis in the original).

I disagree with Foster. Based upon my observations, each individual keeps a close accounting of their contribution to the dyadic relationship. What arises as an issue is concern over the perception of the other party regarding their input, and the uncertainty regarding the degree to which either party plays upon the elasticity of this relationship, recognizing that what is fair and equal is also a matter of individual perception. Given the potential economic and social costs, schisms are carefully avoided, while frequent reciprocated visits for coffee and cakes serve to maintain good rapport. Galt's (1991) description of an Apulian rural communities dyadic alliances is directly applicable to the

Basilicata example:

> Mutual help was a matter of delayed reciprocity, operating much like the classic horizontal dyadic contract described by Foster (Foster, 1961). . . . Exchange, even of tokens (a few almond cookies out of a batch, for instance) held relationships together by creating affective ties and assuring aid in case of eventual need (Galt 1991a:197).

Schisms can occur where the breach is egregious, and this distancing appears to be long-term, if not permanent.

A brief history of the South with reference to land tenure and agriculture

The South is defined by its geography, its history, and its economic alienation from the industrial North. It is comprised of five mainland regions (Campania, Abruzzo-Molise, Apulia, Basilicata and Calabria) and by the islands, Sardinia and Sicily. Historically, the South and its indigenous population have been subjected to wave after wave of colonization, historically beginning with the Greeks in the 8th century BC. The Greek colonies, scattered mainly along the South's coastline and in Sicily, were believed to have gone into a decline with the coming of malaria during the 5th century BC (at the earliest, during the 6th century BC) (Gaetani 1981:16-17). More recent evidence, however, reveals that these colonies remained vital even after Roman conquest of the area in the 3rd century BC (Lomas 1993). During the Punic wars, northern Basilicata is believed to have remained loyal to Rome, whereas the southern zone and a number of its Greek colonies are thought to have allied themselves with Hannibal's forces (Lomas 1993:66-67).

The chain of invasion and domination is a litany of colonizing powers: Greeks, Romans (until 476 AD), Goths (until 527 AD), Saracens, Lombards (568 AD), and Normans (1069 AD) who introduced the feudal system which came to dominate the southern rural economy (Gaetani 1981:18-21). During the Middle Ages, Moslems invaded the mainland from Sicily only to be replaced by other rulers, the Angevins under the Kingdom of the Two Sicilies, "a system of feudalism that lasted almost until modern times" (Gaetani 1981:19). In turn, the Aragonese (1445 AD) replaced the Angevins and imposed Spanish rule for two centuries.

> With the Aragonese, the anarchy of the barons kept the South in servitude and led it to the yoke of slavery to [*sic*] the Spaniards, which was more lethal in the South than in the provinces of Lombardy. The Spanish domination had been lighter in Lombardy than in the South. The Bourbonic government of Parma had

been less evil than the Bourbonic government in the South (Gaetani 1981:19). Following unification (1861-71),[25] heavier taxes were imposed on the South, out of step with what might viably be maintained (Gaetani 1981:21). The economic depression of the South is attributed by Gaetani to this history of colonization and "mining" of agricultural labour under feudalism, but also by the high prices for Church and feudal estates purchased by southern property owners and bourgeoisis (Morano 1994:116ff), draining capital from the South to be reinvested in the North (Gaetani 1981:21).

The feudal system and relative autonomy of the land barons, rather than colonization *per se,* led to the desperate conditions of the legions of landless labourers.[26] It was under these circumstances of despotic land barons, supported by the Church and local authorities, that brigandage arose, the brigands acquiring legendary, heroic status among the disenfranchised (see for example Lotierzo 1986). Conditions in the rural South for the landless were desperate, work was difficult to find, and the glut of labour allowed the propertied to maintain the status quo. Beginning in 1860, waves of emigration began -- a rural exodus primarily of agricultural labourers. This exodus had a profound impact upon the rural South (Gaetani 1981:28-30).

The initial massive migrations following the unification of Italy resulted in slightly improved conditions. An amelioration in tenant and sharecropping (*mezzadria*) agricultural agreements followed, along with the acquisition of small properties in some areas (Gaetani 1981:29). However, with the rise in wages, so rose the cost of living and the capital-impoverished landowners who had drained their pockets purchasing Church and Crown lands, reduced the amount of land under cultivation.

> Crisis or no crisis, from the moment that Lucanian agriculture remained based upon "high labour intensity, and therefore upon low salaries", and from the moment that emigration threatened the strength of the relationship between property and salaried peasants and agricultural agreements, the agrarian bourgeoisis (borghesia) reacted to the peasants' exodus using every method possible to frustrate that the phenomenon followed its course (Conte 1990:54-55).

Out of this crisis arose mutual aid societies, groups of labourers and artisans primarily, but also of professionals (Conte 1990:54-55). Another increase in population was followed by another wave of emigration capped only in 1924 with the American immigration quotas imposed upon Italians (Gaetani 1981:29).

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[25] The unification process began in 1861. Rome was declared capital of Italy in 1871.

[26] For the documentation and analysis of land distribution in Basilicata during the first half of the nineteenth century, see Morano (1994:116-178).

> Many look upon this mass movement as a turning point in the economy of the South. There were some advantages and improvements because of the remittances sent back; but in reality the effect was a limited one and did not remove those negative factors that were the real cause of the southern depression. Serious structural deficiencies remained and so did pressing problems such as lack of water, malaria, a bad road system, lack of schools, and so on. The mass emigration movement in lessening demographic pressures also lessened the vital need for prompt remedial action and thus served to postpone the commitment of the responsible authorities (Gaetani 1981:29-30).

Mussolini's "Battle of Wheat" and Land Reclamation Act (1925) imposed the cultivation of wheat in the South with the goal of making Italy self-sufficient. Importation of wheat into Italy was effectively stopped by massive tariffs, inflating the price but reducing consumption. One informant commented that under Mussolini's wheat campaign, grain was introduced into areas not suited to its cultivation -- on previous forest and grazing lands at high elevations and on slopes where not only the harvests failed, but tillage caused landslips to increase in number (Cancellara, 69 year old farmer). The poor suffered most as they could not afford to purchase much of the staple wheat for bread and pasta. The large landowners profited and conditions did not change for agricultural labourers, although *mezzadria* contracts were encouraged (Gaetani 1981:34-35). During this period of fascism power was reconsolidated in the hands of the propertied elite and the mutual aid societies were destroyed (Lisanti 1990).

> When an exodus occurred from the country to the city, a law was passed preventing movement except by permission of the "prefect" and this kept peasants tied to the soil and wages low. Rural overpopulation was thereby intensified (Gaetani 1981:35).

Conditions did not change until after the Second World War. Property remained in the hands of the few, and any solution clearly required ". . . the breaking up remnants of the feudal order, dissolution of the monopoly on land by land barons, [and] liquidation of properties held by absentee landowners . . ." (Amendola 1979:154). Local history documents empty government promises to provide land to veterans of the First World War and later, promises by the Fascist government to veterans of its Ethiopian campaigns (Stefanile 1979:59-79). In the few successful attempts to provide a small plot of land, the large landowners relinquished only the most inconvenient and least productive of their land. Mass revolts and occupations of agricultural lands in the South reached such proportions during the 1940s that the national government finally had no choice but to act. In 1950 the agrarian reform was begun and the development fund for the South *(Cassa per il Mezzogiorno)* was established (Troisi 1979:139-162; Ginsborg 1990:121-140). Although the land reform forced the sale of land by the propertied, again, the land given up tended to be the least productive and most difficult to work.

> The inadequate nature of the reform laws was almost immediately apparent. In the first place, the landowners naturally tried to avoid expropriation as best they could. Many hastily divided their estates among the members of their family, while those in Calabria madé full use of the ambiguous phrase 'unimproved' land. It was often sufficient to have built even the most rudimentary shed, barn or the like for the land to be classified as 'improved' *(trasformato)* and thus escape confiscation. The very provisions of the law ensured that nearly all land acquired by the peasants was of poor quality. . . . .
> Worse still, the amount of land confiscated was nowhere near sufficient to meet the peasants' needs (Ginsborg 1990:132).

Under the reform, the landless would receive a *podere* (a small farm) the size of which varied from 3-30 ha depending upon the "quality" of the land. Those already with a bit of property received a *quota* of 3-6 ha (Ginsborg 1990:131-132). The number of families requiring land in many areas far exceeded the land available. In one of the communities studied, many of the landless were allotted lands in the marshy Metapontine, in an entirely different environment from their home and more than 100 km from their community. For the most part, the land allocated during the 1950s was insufficient to meet the needs of the household which was meant to rely upon it (Jansen and Jansen 1992:10-12).

> . . . the *poderi* of the interior, with an average of little more than five hectares each, were not given any real chance of becoming self-sufficient. They were created more to split the peasant movement and to reduce social tension in the countryside than to offer any long-term prospect of successful peasant proprietorship. They were there, as Manlio Rossi-Doria put it, *'per resistere'*, until such time as massive peasant emigration solved the problem by eliminating it (Ginsborg 1990:134).

Stefanile (1986) writes of conditions in Oppido, 1952, that:

> Emigration was closed, therefore high unemployment limited even the small income that labourers and agricultural workers would have wanted to accumulate. The salaries were still too low . . . . [Oppidans] were waiting for the initiation of work on the road (S.S. 96) . . . . work that would have occupied the many labourers and fed our town for a good while (Stefanile 1986:127, my translation).

These circumstances were true for the South as a whole. Because there were few employment opportunities outside of agriculture, the rural unemployed awaited the long-promised work constructing the infrastructure of roads and dams. This remains unchanged. In the area, unemployed youth awaited the opening of a factory to build parts for the Fiat automobiles at the nearby town of Melfi. The factory opened during my stay and employed a number of youths from each of the towns in its vicinity. Informants expressed a fear that this factory would follow the same course as most of the others opened in the South and close within a few months. This pattern of northern industry opening factories just long enough to claim State subsidies for industrial initiatives in the South, has been on-going since the Second World War (Edelsward 1994:463, Jansen and Jansen 1992; Gaetani 1981:236; Troisi 1979:159-162, 234-239).

A synopsis of the agrarian reform in the Basilicata study area[27]

State directed agrarian reform[28] began in earnest in 1953 with the purchase of lands from large landowners (land barons), the division of these latifundia, and the allotment of small properties of five hectares or so to each household "for family subsistence." These small allotted properties (*appoderamenti*) had already been established in some cases by large landowners on their own initiative. The *Ente di Riforma* (Land Reform Agency) left these alone to avoid displacing those families already renting or share-cropping (*mezzadria*). In the richer, more fertile zones (low hills and plains) the five hectares or more, were sufficient. However, properties of that size in mountainous zones were insufficient to sustain a family, because large areas were suitable only for pasture.

Many who had been allotted land in the poorer zones emigrated, leaving their *podere* (allotted land). Mass emigration from these areas increased between 1960-1970 with the northern industrial boom and resultant availability of wage labour. Because of this massive emigration, a significant proportion of the lands which had been distributed at the start of the land reform, were abandoned. These abandoned lands were then to be redistributed amongst those who had not yet received their *appoderamento* and had remained in the zone. However, during the period between the start of the program and the redistribution of abandoned *poderi*, the law regarding the sale of lands by the *Ente di Riforma* changed, as well as the price paid.

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[27] This information was gathered through interviews I undertook both with the head office of the *Ente di Sviluppo Agricolo in Basilicata* (the government body responsible for the redistribution of lands in Basilicata), and the field workers responsible for land divisions. The process is on-going.

[28] The Italian structure of governance at the local level is based upon municiple, elected councils responsible to the regional government which, in turn, answers to the State.

Until 1955, the State paid large landowners for the property they alienated. After 1955, the regional governments took over payments at a higher rate, the rate being determined according to the date of possession. A further complicating factor in distributing and redistributing lands was the law established to prevent land fragmentation -- the indivisibility of lands under the program. After 1955, the government began to acknowledge that circumstances had changed, and five hectares were insufficient to sustain a family. Inheritance became problematic as well because the laws established to prohibit fragmentation forbade the division of inherited lands.[29]

Following the collapse of the industrial boom of 1960-1970 emigrant re-entry from particularly North Italy, Germany, Switzerland and France, also added to the difficulties outlined above. Furthermore, because of the absence of available land in some of the communities (such as San Cataldo di Bella), the *Ente* had assigned households lands in other parts of the Region, distant from their home community. Many of these households were unsatisfied with their lot, and returned to reclaim lands they had previously cultivated in their home communities. Between these households and returning emigrants, assigning lands became an extraordinary tangle. People, choosing not to wait for the *Ente* to untangle the mess, began to occupy lands, taking *poderi* without authorization. As a result, the *Ente* is still working in this zone, 30 years after the initiation of the agrarian reform. The officers are dividing entire areas from scratch *(rifrazionamento)*, and are having to reassign *poderi*. In some instances of conflicting claims so confused that they cannot be resolved, workers from the *Ente* have devised the desperate strategy of appearing on-site and arbitrarily assigning the lands to whomever they find on-site when they arrive.

The case of San Cataldo di Bella

As noted above, during the 1950s several families were awarded lands in the Metapontine. Today these are rich lands. However, in the 1950s they were malariaridden swamps. Understandably, the greater part of those who moved to the Metapontine, returned to San Cataldo and took up land they had previously worked under rental or share-cropping *(mezzadria)* agreements. This is but one factor which has contributed to the current situation of confused property ownership.

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[29] These laws were revoked in 1990, allowing fragmentation.

The land reform program was designed to redistribute lands expropriated from the land barons *(latifundisti)*. In the San Cataldo area, these were lands of the *Principessa* (Princess) Ruffo. Expropriated lands were then subjected to *appoderamento* (that is, creating *poderi*) the division of lands into five hectare allotments, lands that were being worked by diverse families under rental agreements from the *Principessa* Ruffo. Hence, *appoderamento* entailed a complete reworking of the previous rented and share-cropped property divisions to create blocks of land of variable sizes to be awarded to individual families.[30] The size of the *podere* was in proportion to the exigencies (number of individuals within the nuclear family) of the family to which the land was to be awarded. This redistribution also insured that each family was awarded a bit of *orto* (vegetable garden) and a bit of vineyard. Thus, a *podere* was formed out of little bits of land that were being worked by several families, and lumped together as one block and awarded to a single family. The actual reorganization and redistribution was to occur at the end of the harvest. However, a number of families balked at the redistribution because not all of the terrains were of similar quality, and they wished to keep farming the lands currently in their possession (lands they had traditionally farmed under *mezzadria* but for which they no longer paid rent because it was land expropriated from the land barons). The whole land division effort *(appoderazione)* fell through as a result. Once a few refused to give up their current lands and accept lands of lesser quality (some assigned *poderi* were steep-sloped and difficult, if not impossible to till except by hoe), it had a domino-effect on the whole redistribution program. Hence, lands are registered to individuals who have never farmed them *(poderi)* and the past fragmented properties of the days of the rental from land barons persist. This is further exacerbated by returning emigrants and additional fragmentation through inheritance.

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[30] Size of the intended *poderi* was gauged according to the number of individuals in a nuclear family and varied according to the zone and ascribed land value for agriculture (size was smaller in the plains as opposed to mountainous zones). A family of 4-5 persons in the San Cataldo area was awarded a *podere* of 5-6 ha; a family of 10, 12-13 ha.

Currently, because of failure of the land redistribution, people are in possession of terrains without being owners, and do not pay rent. Because they are not owners, they do not have access to many of the state subsidy programs. However, few appear to be motivated enough to push the entire community to resolve the current stalemate.

Workers at the *Ente di Riforma* spoke of the particularly strong attachment to the ownership of land in the San Cataldo area. They noted that court cases are fought over tiny strips of only a few centimetres (even less than 50 cm). Like the Oppido area, all parents try to accumulate land to provide an inheritance for their children. I was informed that San Cataldo residents are even purchasing forest land where construction and the cutting of wood are prohibited (*faggeti di alto fusto:* mature beech forest). Over the last three years, the lands remaining to the *Principessa* Ruffo have been and are being sold. San Cataldo residents are purchasing these despite inflated prices. While there is an interest in purchasing lands, there is no equal interest in selling. As a result, fragmentation continues. Furthermore, since most families depend on extra-agricultural employment, they are no longer dependent on the production from their lands to survive. For this reason they can afford to pulverize their property through inheritance. Local conflict over land and property-hunger are problems resulting from an extremely limited land base, and are reflected in a high incidence of first-cousin marriages -- an effort to avoid of further fragmentation amongst those who continue to rely upon farming and pastoralism.[31]

Organizations representing agricultural producers (Oppido Lucano)

I interviewed administrators of agricultural organizations in Oppido Lucano, collected information informally and through interviews with farmers and *pastori* regarding the agricultural organizations and cooperative structures present in Oppido. Affiliation with an organization is based upon three internally coherent categories correlated with land ownership and political persuasion. The C.I.C *("Confederazione Italiana Coltivatori")* represents the left. In 1920 this organization was known as *"Camere del Lavoro, Sindacati dei Braccianti Agricoli"*, and represented the poorest class of people engaged in farming: the landless, agricultural labourers. The large landowners with *"latifondi"*, on the other hand, are represented by the right-wing *"Confagricoltura."* The *Coltivatori Diretti* (previously called the *"Confederazione Nazionale dei Coltivatori Diretti"* and the strong arm of the D.C. party, the Christian Democrats), represents the middle of this political and property-based spectrum. Its membership is composed of proprietors of small to medium sized farms and moderate wealth. This group has grown to have the largest membership of the three organizations in Oppido. A number of factors contributing to the growth of a "middle-class" of farmers and *pastori* are the agrarian reform, inputs into agriculture through the national fund for the development of the South (the *Cassa per il Mezzogiorno)* such as low interest agricultural loans and the building of a regional infrastructure, and European Common Market subsidies.

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[31] First-cousin marriages also occurred in other areas in the past, for the same reason. Two informants in another area reported that they had been subjected to heavy family pressure to marry a first cousin in order that the families consolidate their properties. In both cases the individuals were disinherited for refusing the marriage.

Services provided by the *Coltivatori Diretti* to their membership are broad. The organization provides help in dealing with the massive paperwork involved in farming -- all the fiscal aspects, as well as the recording of properties and inheritance. They also help in the claiming of Common Market subsidies managed by the Region (EEC devolved regulations, especially 1765/92 which regulates monies paid to a farmer for growing a particular crop).[32] The Coltivatori Diretti also provides technical assistance to farmers by referral to experts to deal with particular problems.

Like membership in the agricultural organizations, cooperatives were based upon political inclination. There are few cooperatives left, and those that remain sell their products to the *Consorzio Agrario* -- a "second level" cooperative. This organization is regulated by national laws and coordinates purchasing and selling for the various sectors of production (milk products, wheat, market gardens and fruit production, grape production) which remain as cooperative structures. The *Consorzio Agrario* also sells seed cereals and legumes. Olive cultivation, hard wheat production, and market garden and fruit production were originally marketed through cooperative structures. However, EEC funding has undermined the cooperatives. These have been replaced by *Associazione di Produttori* (Associations for Producers) for marketing in each production sector (livestock, olives, wheat, market-garden produce and fruit).

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[32] These EEC regulations are funnelled first through the Italian national government (EIMA = *Ente per gli Interventi nel Mercato Agricolo*), and then the Regional government which passes them on to the agricultural organizations. The Regional government's interpretations of the EEC regulations and policies are subject to EEC approval. This results in lengthy delays between the EEC policy formation and the application of new guidelines at the Regional and hence, farm level. EEC subsidy payments are now calculated according to the new European currency the value of which is established every 01 July, effective until the following 30 June. At the time of the field research, 1ECU "Green" (agricultural sector) = Lire 2274.

The European Economic Community and the Common Agricultural Policy

European Common Market subsidies bear special mention because in latter years, these have influenced crop choices made by farmers. The European Economic Community has instituted a Common Agricultural Policy (CAP) through which prices and production levels, subsidies ("contributions"), tariffs, etc., are established between the member states. In the Basilicata study area, production of wheat, sheep, goats, cattle and olive oil are subsidized through E.I.M.A. *(Ente per gli Interventi nel Mercato Agricolo)* the national body managing Common Market agricultural policy and funding for Italy.[33] State contributions for the cultivation of other cereals and legumes in the Region are significantly lower. While I did not collect the actual figures, farmers consistently indicated that their preference in rotation had been undermined by the economic penalties for not growing wheat. In pragmatic terms they were "taking advantage" of the subsidies available, and in Basilicata, the highest contributions are for the cultivation of hard wheat which has resulted in the cultivation of this cereal for consecutive years on the same land. Informants complained that they would rather rotate wheat with other crops such as barley and forage legumes, but these other crops are not subsidized to the same degree. Many informants commented that the current subsidies in Basilicata only encouraged monocropping, whereas they would have favoured subsidies of equal value for the cultivation of forage legumes such as *Vicia faba* var. *Minor*, or vetch *(Vicia sativa)* which would benefit rather than impoverish the soils, and could be cropped in rotation with wheat. Regional programs vary, however. In the neighbouring Region of Apulia, a small horse bean *(Vicia faba* var. *Minor)* is subsidized on par with hard wheat. For this reason, it is extensively cultivated. However, in spite of these subsidies, farmers in both regions return to the traditional rotation once they begin to perceive a loss in soil fertility. In Apulia, where the clay soils readily form an impermeable crust (rendering them impervious to precipitation while impeding plant growth),[34] the subsidies encourage a rotation between wheat and legume.

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[33] Previously called A.I.M.A. *(Azienda di Stato per gli Interventi nel Mercato Agricolo)*, the State Enterprise for Intervention in the Agricultural Market.

Subsidy programs initiated by the EEC and enacted through regional legislation, currently take the form of a fixed sum per hectare cultivated to wheat in Basilicata. All the wheat farmers noted that the combined costs of seed, diesel fuel to run their cultivators, tractors and combines, herbicides, and fertilizers actually rendered only a small profit because of the low market value for wheat (again set by the EEC). The profit in wheat cultivation derives from the subsidy program. Hence, the European Common Market system of subsidies for wheat production in Basilicata has eliminated the economic risk inherent in such a strategy within a drought-prone environment. Even if the wheat fails to reach maturity or the crop is destroyed by drought, the producers are guaranteed a profit.

Rather than payments for milk production, the Basilicata Region (through EIMA) pays subsidies per head animal. As is the case for cereal (wheat) production, profit is largely derived from subsidies rather than value of the product at sale. Informants reported that the policies relevant to their production frequently shifted. This has to do with quotas set by CAP for Italy. For example, one year, *pastori* could claim subsidies for increasing their flock, while the next year they could receive subsidy payments for slaughtering animals. In this way, a number of informants joked, speculative producers purchased one year and slaughtered entire flocks the next. This practise is also noted by Ayora-Diaz (1993) in his study of Sardinian pastoralism:

> The EEC has designed general economic policies, the application of which, at the local level, is often perceived as contradictory and confusing: for example, there is a subsidy paid for each head of livestock, and simultaneously (since the end of 1991), a subsidy paid to reduce their flock size. There are also subsidies to eliminate vineyards and subsidies to plant them. Local producers (and some provincial officers) told us that they find themselves frequently confused by the heterogeneity of rules and policies (Ayora-Diaz 1993:107).

These shifting policies are meant to act as 'stabilizers' in a set European market of price supports. During the period I undertook fieldwork, the EEC had instituted a 'stabilizing' program for cereal production, the 'Set-Aside'. This policy was "a voluntary and cost-effective scheme designed specifically to take land out of cereals production, and could also help to relieve the pressure imposed by an increasingly market-oriented price policy'" (Tracy 1989:323). In the main study area, all producers held land under the five year set-aside, extended fallow. Through this program, producers received subsidies equal to the wheat subsidies had their land been sown to wheat. Tracy remarks of this initiative that "the Community seems to have embarked on the business of paying farmers not to produce for the wrong reason, as an alternative to a realistic pricing policy" (1989:325). On the ground, the policy prohibited the use of these set-aside lands as pasture (up to 15% of the arable land/producer), and at the same time, the lands were to be ploughed four times over the course of each year under fallow. In actuality, the fallows were left unploughed as a cost-saving measure (in diesel), and the prohibition on grazing (although not strictly adhered to) resulted in a build-up of seeds from spontaneous growth in the soils. In the course of EEC negotiations to establish this policy, a concession was made to satisfy the French, allowing "as an alternative to complete withdrawal from production the option of having livestock graze the land on an extensive basis or to plant it with certain legumes. In these cases, lower rates of compensation are paid" (Tracy 1989:324). Again, the lesser rate and pragmatic calculations of costs and benefits mean that producers elect the most lucrative option.

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[34] Note the role of sheep's hooves below (Chapter 6).

In 1992, the European Community introduced a new agricultural program geared to reducing industrial agro-chemicals inputs, and encouraging "biological methods." By 1994, the program had made its appearance in the form of new incentives for "an agriculture respectful of the natural environment in Basilicata", what is known as the EEC regulations Nº 2078/92 (Basilicata 1994). Particularly, the Basilicata program aims to "promote Lucanian products, to protect the environment and defend consumer health", through the use of "biological farming methods" (Basilicata 1994:11, my translation). Measures to achieve these goals include reducing (but not eliminating) the use of agro-chemicals (fertilizers, herbicides and pesticides), rotations including sown forage legume pastures and more generally, rotations of cereals followed by legumes, reduction of depth of ploughing and encouragement of minimum tillage (discing as opposed to ploughing) (Basilicata 1994:11-24). The consensus among Basilicata informants who had investigated the program incentives was that it was too restrictive and offered fewer economic advantages. Under the program, the farmer would be obligated to dedicate the entire farm to "biological farming" methods, and thereby be enjoined from taking full advantage of wheat subsidies. Furthermore, the program also entails removing "marginal" lands from cereal production for a twenty year period (Basilicata 1994:53-57). Interest in the program had been expressed initially by many farmers, but according to the administering agricultural organizations, none had followed through after weighing advantages under the current wheat subsidies against the subsidies proffered and restrictions proposed under the new program.

In the Introduction I made reference to the difficulties involved in establishing precise numbers of hectares under cereals, number of animals in a flock, and the resultant unreliability of government statistics and any records held by livestock and agricultural organizations. Ayora-Diaz (1993) sets out the extent of this phenomenon in Sardinia, a description which can be equally applied to Basilicata:

> It is often the case . . . that villagers cheat the Region and other administrative agencies with the compliance or acquiescence of the local administration. As in patronage relations between shepherds and state among the Sarakatsani (Cambell 1964), both the local administration and the police (carabinieri and others) turn a blind eye to some illegitimate (sometimes illegal) practices. . . . we were told by both shepherds and officers that shepherds adjust the number of the animals they register according to the benefits they can obtain. For example, when shepherds have to register their animals in order to pay the rate for their right to use communal pastures, they register small flocks. If they should register their flock in a different agency in order to gain access to funds from the Region and the European Community, they tend to inflate the size of their flock. . . . . Some mechanisms are supposed to be in effect to check for irregular practices, but falsification of numbers continues to be widespread, involving shepherds and government officials alike (Ayora-Diaz 1993:64-65). Inflating numbers is, however, not a practice exclusive to Sardinians (Ayora-Diaz 1993:65).
>
> These cases illustrate the generalized practice of adjusting numbers in order to obtain monies from governmental and international agencies. At the local level people either under- or over-report their livestock but produce more milk and dairy products than they are supposed to do according to their registered resources (Ayora-Diaz 1993:66).[35]

Government programs, whether State or EEC initiatives, agricultural pensions or agricultural subsidies are carefully and fully exploited by rural Basilicatans. Within the study area, I learned of many instances in which the State or Region had been "out-smarted", although the fact that the State is aware of these practises suggests that these "loopholes" and lack of investigation for the most part, actually serve to transfer funds in to the South in the place of welfare payments (see Bonanno 1987).

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[35] See Vargas-Cetina (1993:70-85) for her discussion of patron-client relationships and *furbizia* (cunning) in this context. These relationships between shepherds and officials tend to be based upon clientelism.

Mutual-aid alliances function to get the most out of the subsidy programs available. For example, household management of biennial olive production provides an illuminating example of the informal, reciprocal economic exchanges between households. Under the CAP, olive oil production is also subsidized through contributions (Tracy 1989:310), up to a maximum per household, but based upon annual production. Olives are biennial, producing abundantly only every second year. Most households prune half their olives one year to produce fruit the following year. Few households have sufficient trees to split production to meet the amounts necessary to claim the maximum contributions through the Common Market program every year, and production also varies with each year depending upon the growing season. In practise, those with fewer trees can count on only sufficient olives to produce enough oil for a maximum claim every second year. This problem is resolved by purchasing olives informally from those with excess. In this way, everyone manages to claim the maximum subsidies for olive oil production every year.

Overall, the CAP has had an enormous impact upon production, although it is generally understood to have benefited most those already possessing terrains and equipment rather than the small producer (Edelsward 1994:159, 489-492). Nevertheless, the contributions supplied through the CAP also profit small producers who tend to "market" their goods through the local informal sector.

> By and large, agriculture has moved from a peasant economy characterized by overpopulation and *miseria*, to an 'assisted economy'. This has occurred because those who remained on the land or those who have become farmers, can exploit the various financial supports offered to European Community farmers in general, and to those in the so-called less favoured areas, in particular (Jansen and Jansen 1992:117).

The local, tax free market benefits more the smaller producer than the large producer who markets directly through marketing organizations, structures monitored by the State as part of the formal economy. Informants throughout the study area speak of the enormous changes that have occurred during the last three decades, and the vast improvement in the standard of living for the majority of the rural population which they attribute to land redistribution, State funds through the *Cassa per il Mezzogiorno*, and the Common Market subsidies. Despite such massive changes small-scale agro-pastoralism has persisted. For this reason, I suggest that small-scale agro-pastoralism must be considered in light of both the economic and social context in which it occurs. The importance of self-sufficiency in household production, the value placed upon local produce, the social relationships in which production and exchange take place, and the avoidance of the formal economy are all significant to the persistence of tradition in rural Basilicata.

CHAPTER 3

THE PHYSICAL ENVIRONMENT

> The mountain rose up as before, with its gradual rises and irregular crags, to the cemetery and the village, but the earth which I had always seen gray and yellow, was now an unexpected and unnatural green. Spring had suddenly burst forth during my brief absence, but the green, which elsewhere is a symbol of harmony and hope, here seemed artificial and violent; it was out of key, like rouge on the sunburned cheeks of a peasant girl. This same metallic green extended all the way along the mountain road to Stigliano; it was like the false notes of a trumpet in a funeral march. The mountains closed in after me like prison gates as we went down toward the Sauro Valley and up again toward Gagliano. In the sunshine little patches of green that were scattered over the white clay stood out even more intensely and strangely than before, like expostulations. They seemed the torn pieces of a mask, thrown down at random (*Christ Stopped at Eboli*, Carlo Levi 1947:255).

Like Carlo Levi,[1] I had expected to find the sunburned landscape and silvery olive trees which had greeted me in my previous experience of Basilicata. Instead, the early March trip by car from Naples revealed a different landscape. The tortuous roads that lead from Potenza to outlying communities were familiar to me, defined by a rocky landscape traversed by car in descents from one hill town along snake-like roads of sharp, almost overlapping curves, and ascents in equally tight curves to the next town. Unfamiliar, however, was the vibrant green Levi describes of growing wheat in a patchwork of scattered fields. The olive leaves not having yet turned to deflect the sun added unexpected tones to the verdant, lush landscape. The swallows had already arrived; for Oppidans, their arrival signals spring. Blooming in a few warmer spots in the valleys with south-facing exposures, was the perfumed *ginestra* (Spanish broom, *Spartium junceum*) which a few weeks following my arrival, turned hillsides yellow with their blossoms, punctuated still with the few remaining white flowers of *biancospino* (*Crataegus monogyna*), first to bloom. Wild pear, cherry, almond trees and apricots were all in bloom, first those in the valleys and then up the hillsides, first on one face and then on the other. In the wheat fields began to proliferate the red poppy (*Papaver rhoeas*) and wild mustard (*Sinapis arvensis*). By the end of May, the olive leaves began to rotate, turning their silver undersides towards the sun, the fields turned a golden color, and the spontaneous vegetation was a full bloom of mallow (*Malva*), geraniums, borage, chamomile and melilot (*Melilotus*). Previously burned pastures blossomed deep pink with vetches, and red with clovers and milk-vetch (*Astralagus*), yellow with medicks, lathyrus (*Lathyrus aphaca*) and birdsfoot trefoil (*Lotus corniculatus*), creating a riot of color. By June, the valley below was brown, barley and oats having been harvested earlier, the wheat harvest had begun. Clouds of chaff and dust marked the path of the combines, the heat of the sun distorting their shape from a distance. For me, the constant sound of cicadas recalls the heat and the itch of chaff rubbing against skin. By August, the entire landscape was brown, and fields began to appear striped black where fire had caught up trails of chaff left by the combines amongst the stubbles. Black ash of burnt stubbles carried up by the wind well above the fields, invaded homes throughout the town. It is this arid, desiccated landscape which Levi first saw arriving at Gagliano in August 1935. Almost 90 kilometers from Oppido Lucano, the Basilicatan hill town he describes is not much different from those I visited in the course of fieldwork, and his shock at the transformed landscape is no poetic overstatement, but an accurate depiction of the contrasting winter rainfall - spring growth, and summer drought landscapes.

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[1] A doctor, writer and painter, Carlo Levi was exiled to a small hill town in Basilicata in 1935 for his outspoken opposition to the Fascist government. Christ Stopped at Eboli: The Story of a Year is his vivid account of the conditions he found in a region of Italy of which most Italians were ignorant; a narrative which became a catalyst for economic reform in the Mezzogiorno. While not an trained ethnographer, Levi's insightful description of life and its social context in Basilicata has had a longstanding influence on ethnography in rural South Italy.

Levi (1947) draws together in a single paragraph the most important aspects of the physical environment; that is, a dissected landscape of extremes in elevation, the mosaic of arable and untilled lands, and the impact of precipitation.[2] Below is a brief synthesis of these environmental variables considered in light of what Basilicatan farmers and *pastori* identified as significant in their subsistence practises.

> . . . for agriculture, the term climate has a broader and more complex meaning, representing all the conditions of the place (air, water, soil) permanent and also temporary, capable of exerting an influence on plant and animal life (Viggiani 1931:509, my translation).

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[2] The geography is characterized by the juxtaposition of extreme vertical relief in a confined area. Commonly, the boundaries of any production unit (agro-pastoral farm system) extend to include a cross-section of the topography.

Geology[3]

> Geologically [South Italy] is one of the most wretched regions that one can imagine. The higher mountain nuclei which are the most ancient [geological feature] . . . are constituted by a ponderous framework of Triassic limestone, [chert] nodules and calcareous marl (De Lorenzo 1929 in Viggiani 1931:513, my translation).

The geological heterogeneity of the Italian Mezzogiorno as a whole can be attributed to its tectonic history and complex, disrupted stratigraphy. The Apennines are a chain of mountains formed from plate pressure, mostly from the Tyrrhenian (west) side during the Tertiary period (*c.* 65 to 2 million years BP).[4] Composed of sediments deposited in what was the Tethys Sea, these flysch deposits (fine-grained sandstone shale and clay sediments) overlie Mesozoic (*c.* 225 to 65 million years BP) calcareous-marl and dolomitic limestone formations. The orogenic (mountain-forming) pressures caused massive movements, uplifting, faulting and upending of these formations, ultimately forming a highly unstable structure. Typical of the Mediterranean Basin, most of the bedrock in Basilicata is calcareous (Blondel and Aronson 1995:47), composed of soft shales, limestone and sandstone formations, an area which continues to be subject to earthquakes and frequent landslides.

The Bradano Valley separates the southern Apennines to the west from the Apulian Murge to the east -- a limestone plateau rising above the valley, forming an arid landscape of jagged rocks with little soil coverage. An example of the erosive nature of the bedrock and soils is exemplified by the geological history of the Bradano Valley below Oppido Lucano (see Vita-Finzi 1969 for historical examples). The Bradano Valley depression which had been open to the Ionian Sea, began to be filled by sediments eroded from the mountains to the northwest during the Quaternary period (2 million years BP). Subsequent periods of inundation and glaciation produced the Metapontine plain and left behind a series of moraines evident throughout the valley. The soft bedrock strata have been deeply incised by rivers that drain into the Ionian Sea.

The Bradano River flows year-round, but most streams are seasonal, and even portions of the Alvo, flowing between Oppido Lucano and Tolve, dries during the summer months running underground for stretches to reappear a kilometre downstream.[5] Because most streams in this area are seasonal, the majority of Basilicatans rely on well or spring water. Permanent springs are scattered across the landscape, the water from these is tapped, draining into pools many of which serve to water animals, and a majority of the spring sites reveal a lengthy history of use.[6] Dams have been constructed throughout Basilicata, one of which has been built (but has not been completed) below Acerenza to carry water by aqueduct to the more arid zone of the Bradano plain, towards Apulia. Only one informant had built a dam for private use.[7] Otherwise, spring and well water are used to irrigate vegetable gardens, to water animals and for household use. Field crops typically are not irrigated in this area.[8]

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[3] Information for this section is compiled for the most part from Campbell (1994), Rivolta and Cucarzi (1994), Basilicata Region (1993), D'Anisi (1991).

[4] "BP" is an abbreviation for 'years before present'. When used in conjunction with a radiocarbon date, present refers to AD 1950.

Communities located in the Apennine mountains and along its foothills, in the Bradano Valley and on the Apulian Murge are included in this study. Oppido Lucano (670 m a.s.l.) is located at the southeastern edge of the Apennine range, the lands under its jurisdiction straddle both mountain (815 m a.s.l.) and the broad upper Bradano on average about 300 m lower than the town site. Cancellara (689 m a.s.l.), Vaglio (954 m a.s.l.) and Tolve (568 m a.s.l.) are nearby communities situated in somewhat more mountainous terrain. Topographically, these hill towns are surrounded by other high hills intersected by narrow valleys (see Figure 5). Bella (662 m a.s.l.) is also a community intermediate between hill and mountain. Most of its lands are mountains covered in beech and oak at significantly higher elevations than the community itself. Abriola (957 m a.s.l.), Anzi (1008 m a.s.l.), Calvello (795 m a.s.l.), S. Cataldo (900 m a.s.l.), Ruoti

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[5] These various communities are also identified according to the geographically defined principle drainage basins in which they occur (Caloiero et al. 1993). Oppido Lucano, Cancellara, Tolve, Irsina are of the Bradano basin. Potenza, Vaglio, Anzi, Calvello, Abriola occur in the Basento basin. Avigliano, Ruoti, S.Cataldo, Bella and Muro Lucano occur in the Sele basin (Caloiero et al. 1993), the Marmo-Melandro catchment area (Basilicata Region 1993: 26-27), Figure 4.

[6] Springs are often associated with votive offerings, dating to pre-Roman and Roman times.

[7] This agro-pastoralist purchased land on either side of a stream that flows into the Bradano, and put in a dam to irrigate a field of sown barley pasture (*foraggine*), described in Chapter 4.

[8] A few irrigated fields of perennial medic (*Medicago sativa*), especially in the area of Bella and San Cataldo di Bella exist -- all near springs from which water is pumped. These are but a minute fraction of lands under cultivation, and most medic fields are not irrigated.

(751 m a.s.l.) and Avigliano (800 m a.s.l.) are all mountain communities (Plates 1 - 12). Most arable lands are located on the slopes below the communities which descend to the torrential, seasonal stream and river beds that dissect this landscape. The uplands are forested, dominated by oaks, which are interspersed with beech and chestnut trees at higher elevations, and used primarily as pasture and for collecting firewood. Undulating hills and plains characterize the topography of the more arid zone in which Irsina (province of Matera) and Minervino Murge (Apulia) are located. Irsina shares many of the topographical characteristics of Oppido Lucano, while Minervino Murge is typical of the Apulian arid, rocky plains.

Soils around the mountain communities of Avigliano, Bella and Cancellara are dominated by clays, Oppido Lucano by sandy marls and calcareous marls (the principal component of which is clay). Ruoti, San Cataldo di Bella (only 4 km from Avigliano), and Anzi have similar clay soils, and also conglomerates and loosely bound sandstone. A comparable assortment of soils are found in the communities of Abriola and Calvello, Oppido Lucano and Vaglio. Around Tolve and Irsina, soils are dominated by sandy and silty clays. The higher mountains surrounding these communities are composed of volcanic gneiss. Volcanic soils do not extend into the areas studied, but are centred upon Mount Vulture, volcanic crater lakes (the *Laghi di Monticchio*) to the north.

For farmers and *pastori*, the most significant aspects of the geology are the instability of the soils and the variable clay content; soils tending to a neutral to alkaline reaction (6.6-7.5 pH) (Great Britain Admiralty 1945:9; Monckton and Campbell 1994:16; Arnon 1992:85; Yassoglou et al. 1964:63-64 for Greece).[9] A descriptive phrase used throughout the region by farmers and *pastori* is that soils in their fields "vary with the palm of a hand," referring to the frequent changes within a single field between various clays and sandy soils (see Angioni 1989:63 for the same saying among Sardinian *pastori*). When questioned about the division of crops according to soil type, farmers denied that they chose crops on the basis of soils, except to indicate that certain leguminous crops would grow or not grow in their soils (I suspect because of an absence or presence of plant-specific bacteria necessary for nitrogen fixation). Rather, elevation, incline of slope and exposure were deciding factors in the selection of fields and crops. The information supplied is consonant with plant ecologists' conclusions:

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[9] The preponderance of soils in Basilicata are formed from limestone deriving from the Mesozoic and Tertiary calcareous formations that commonly overly Mesozoic deposits (Basilicata Region 1993:28-30). The dolomitic limestone layers of the Apennines, younger sandstone deposits, and in some areas, glacial tills from moraines, generate a great deal of heterogeneity in the soils.

> Sites differing in aspect (north vs south-facing) were more profoundly different in the nature of returning vegetation two years after fire than were sites which differed in substrate (volcanic vs sedentary) (Westman et al. 1981:173).
>
> In Mediterranean hill regions, topographical position, and in particular slope and aspect, is generally recognized as a major factor affecting plant distribution and demography through its effects on radiation, temperature and soil moisture regimes . . . (Noy-Meir et al. 1991b:364).

Discussed in greater detail below (Chapters 4 & 6), informants in Basilicata identified a number of strategies adopted in farming and pastoral practises in the Mezzogiorno to manage clay soils. Evidence of past cultivation on terraces now abandoned, mark many south-facing slopes in Basilicata. These terraces acted to slow the inevitable movement of soils from mountain to valley. Oppidans refer to the valley as "the greenhouse" -- the destination of minerals from mountain soils, run-off precipitation, and ultimately, the soils themselves. During the summer drought period, but also in winter, clay soils develop crevasses (Hall 1920:328) into which water from the intermittent, brief rainstorm infiltrates and causes landslides. Farmers create channels in their fields to carry off water to avoid flooding on the clay soils and landslides. To mitigate the effects of precipitation on soils, farmers also "fix", or "adjust" the slopes of their fields, modeling the steeper terrains to reduce the angles of slopes. The prevalence of landslides can be attributed only in part to the periodic removal of forests and the tillage of steep-slopes. Dell et al. (1986) observe that mediterranean-type soils, by their very nature, are infertile and subject to erosion; landslides are an inevitable product of the geology (see also Great Britain Admiralty 1945:105). However, as an meteorological service officer indicated to me, the massive floods in North Italy the 07 November 1994, might not have been as widespread and destructive had not so great a proportion of previously farmed slopes been abandoned; farmers he noted, "are the first line defence in controlling water courses and erosion" (also Dall'Aglio and Marchetti 1991:166; Naveh 1991:548).[10]

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[10] Brückner (1986; 1990) correlates erosion (alluviation in valley bottoms) with periods of intensive land use and deforestation. However, silting also reflects periods of abandonment. Relevant also, the greatest proportion of land surface (65% in Lucania) is covered by *macchia* vegetation which has a soil erosion rate near zero (Brückner 1986:15).

Vegetation Zones

> Temperatures are influenced by the orography [mountain physical geography] of the territory, which in turn, in conjunction with precipitation, influence the territorial distribution of vegetation types (Basilicata 1994:8, my translation).

The vertical gradient is characterized by marked plant zonation, a distribution carefully managed by Basilicatans. Described in Chapter 1, high mountains and hills with complex ridges and steep slopes (Naveh 1987:643) establish conditions of great variability in microclimates which is in turn reflected in the variable distribution of flora (Blondel and Aronson 1995:49; Buddenhagen 1990:6-7; Campbell 1994). The heterogeneity of the environment, a "mosaic of microsites", is one factor contributing to the broad intra-specific variety that is found in Mediterranean flora (Naveh and Whittaker 1979:183). Because of the temperate climate (an absence of extremes in temperature), the flora of the Mediterranean Basin is varied, comprising some 25,000 species (Blondel and Aronson 1995:49). However, this variety is also attributed to the creation of anthropogenic landscapes, human management and maintenance of productive vegetation -- especially noted of the Mediterranean *macchia* (e.g. Zohary 1960: 61; Hobbs et al. 1995:19). With reference to plant communities in Greece:

> Much of the wildwood may well have consisted of small, stout, hard, and intractable trees, casting a dark, dry shade beneath which nothing would grow, and yield nothing but wood and small amounts of pasture. What has replaced it is by no means the useless 'scrub' that the geographers often suppose. It is a complex, beautiful, and resilient mosaic of vegetation, containing a wider range of products . . ." (Rackham 1983:347).

Monckton and Campbell's (1994:16, Table 4) synthesis of the main vegetation zones derived from their study of the San Cataldo area is applied here as a general guide.

Table 2: Elevation, soils and vegetation in South Italy (from Monckton and Campbell 1994:16).

	Elevation (m a.s.l.)	Mean annual temp. (°C)	Mean min. monthly temp. (°C)	Soil	Characteristic vegetation
Mediterranean	0-500	14-19	9-4	Mediterranean red earths, *terra rossa;* clay and clay loams	*Macchia. Quercus ilex* L.; *Myrtus* spp.; *Erica arborea, Olea europaea*
Lower montane	500-1,200	10-14	6-0	Brown to reddish brown forest soils; loams & clay loams	Lower beech, oak & chestnut. *Fagus sylvatica, Quercus cerris, Castanea sativa, Abeis alba*
Montane	1,200-1,800	7-10	-1	Minimal – dark & grey-brown podzolics; loams	Upper beech, fir and pines *Fagus sylvatica, Castanea sativa, Abeis alba, Pinus* spp.

The 'Mediterranean' and 'Lower Montane' zones ranging from 0 - 1,200 m a.s.l. and their characteristic vegetation predominate, arranged geographically in

> . . . thermal belts which vary more or less regularly as a function of latitude and altitude. Precipitation decreases in the same direction [i.e., with latitude and altitude] (Blondel and Aronson 1995:47,49).

Communities (towns and villages) are located on promontories, typically surrounded by higher mountains (see Figure 5 below). The lands immediately surrounding towns, are intensively cultivated to vegetable gardens (*orti*), vineyards and olives (*Olea europaea* var. *europaea*) on favourable slopes (south and east facing, or southwesterly-facing slopes) up to *c.* 700 m in the Basilicata area, although they are documented in Jordan up to 800 m a.s.l. (Neef 1990:296). Cultivated in favourable areas at elevations exceeding those delimited by Monckton and Campbell (1994, above), olives grow best at lower elevations, restricted to warmer micro-environments.[11] An informant in Cancellara commented that their olives do produce fruit, but because of the higher elevation (cooler), the fruit does not yield as abundantly, nor is oil pressed as good as that from olives grown at lower altitudes in the environs of neighbouring Oppido Lucano.

Oak and beech forests define the upper slopes of pastured areas in the higher communities. Beech and chestnut trees occur on the slopes above Vaglio, Bella, San Cataldo di Bella, Avigliano, Abriola, and Calvello. The upper slopes around Oppido Lucano, Tolve, and Cancellara are dominated by oaks, while further downslope is found

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[11] Olives will not survive at locations where temperatures drop below -13°C (Rackham 1983:31).

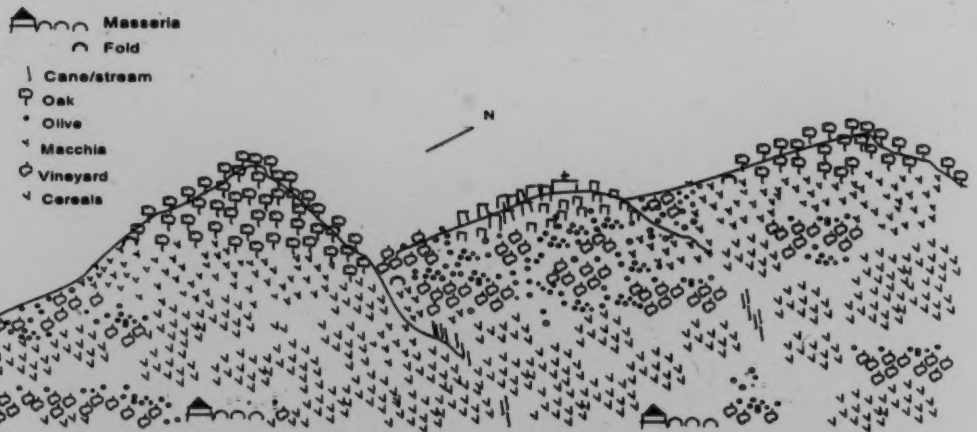
macchia and cereal fields. At higher elevations soft wheat (*Triticum aestivum*) is cultivated rather than hard wheat (*Triticum durum*).

The zonation described above serves as a general guide, but is misleading if considered the rule. A more precise description of the vegetation landscape is a mosaic of interspersed vegetation types, or "patches." Sown fields are interspersed with fallow and pastures; oak copses also occur in the valleys, especially near streams; sown fields occur also at higher elevations, within forested zones. The overall effect is one of "patchiness", or a mosaic of vegetation forms.

> A patch is an ecologically distinct locality in the landscape . . . . . For an ungulate, isolated mountain meadows or localized areas of fire-regenerating brush might represent patches. In general, patches are localized discontinuities in the landscape which affect behavior, they are assessed in terms of properties like the number of patch types and their size, quality, turnover and developmental dynamics (e.g. succession), and distribution (Winterhalder 1994:33).

These patches are anthropogenic, created and maintained by the farmers and *pastori*. Described in subsequent chapters, within this fenceless landscape the patches or mosaic of vegetation types are also a visual record of property, of economic activities, and of the interrelationships between agriculture and pastoralism.

Figure 5: Representative Basilicata landscape from 400 to 800 m a.s.l.



Detailed further in later chapters where a fuller discussion is merited, the general characteristics of mediterranean-type flora are set out here. Botanical-ecological literature relevant to mediterranean-type plant communities is used for reference and analysis. However, this is not a formal botanical study. The vegetation identified by farmers and *pastori* is that which is discussed. Neither are the plants identified comprehensive of species present in plant communities encountered. Rather, the plants described are limited to those said to be significant by informants, and which were observed to be favoured by flocks. In particular, readers will note an emphasis on grasses and legumes throughout which, reflects their prevalence in the flora.

> The species/genus ratios of grasses and legumes . . . are quite high in relation to the overall floras. These two families, therefore, contribute more than average to overall diversity of these [mediterranean-type] floras at the specific level (Blondel and Aronson 1995:85).

Further, the emphasis by informants on grasses and legumes was marked. This emphasis is reflected below and in subsequent chapters.

> In . . . regions of mediterranean climate, the vegetation is characterised by the dominance of woody shrubs with evergreen leaves that are broad and small, stiff and sticky (sclerophyllous). An overstorey of small trees may sometimes be present as well as an understorey of annuals and herbaceous perennials. This vegetation type is usually called 'maquis' in France, 'chaparral' in California, 'matorral' in Chile, 'fynbos' in South Africa and 'heath' or 'mallee' in Australia (di Castri, 1981) (di Castri 1991:3).

In his study of Boeotia (Greece), Rackham (1983) distinguishes three plant communities[12] which I (and Monckton and Campbell 1994, above) combine under the term *macchia* vegetation. For Rackham (1983:301), *macchia* is characterized by shrubs, including lentisk (*Pistacia lentiscus*)[13] which Basilicata informants also identified as distinctive of "true" *macchia* communities. These abound in the vicinity of Tolve more than any other community studied. Rackham's "steppe" plant community is defined as a transitional community (an ecotone) characterized by annual legumes and grasses -- in Basilicata, by Spanish broom (*Spartium junceum*), an archaic cereal, *Aegilops ovata*, *Asparagus acutifolius* (in many pastures), medics, clovers among other grasses and legumes. This transitional community, between the *macchia* and *gariga* in Rackham's classification (based on traditional Mediterranean botanical definitions), is the most prevalent among the landscapes studied. The *gariga*, also present in the Irsina, Tolve, Oppido Lucano and Cancellara area is defined by the presence of wild herbs such as thyme, oregano and sages. These vary according to micro-environments, but as Rackham (1983:305; see also Bintliff 1994) acknowledges, their form and presence is dependent upon and shaped by fire and grazing; the distinction between one community and the next is arbitrary. Variable elevations and exposure results in a patchy distribution of these plant communities across the region. In the zones ranging from Cancellara to Tolve and including Oppido Lucano, all three plant communities are represented. However, at higher elevations, Rackham's (1983) communities are truncated by altitude and limited to the steppe vegetation of *Spartium junceum*, annual grasses and legumes. While informants distinguish "true" *macchia*, all areas neither forested nor tilled, are classified by them as *saldone*, a dialect term possibly from the Latin *saltus* meaning mountain pasture, but here used more broadly as untilled pasture and grasslands. All are characterized by grazing- and fire-adapted plants (e.g. Zohary 1960:64; Naveh 1974, 1984; Naveh and Whittaker 1979; Quinn 1986:124; Bintliff 1994:136; Rackham 1983:346).

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[12] Zohary (1947:7-12) describes parallel communities in western Palestine -- *maquis*, *garrigue*, and semi-steppe *Batha* and *Batha* (dwarf-scrub) communities.

[13] Olives and lentisk are restricted to elevations of 700 m or less (Rackham 1983:318).

Fallow fields tend more to forbs, such as *Rumex* spp., *Amaranthus retroflexus, Sinapis* spp., *Xanthium* spp., *Polygonum* spp., etc.,[14] and grasses such as wild oats, *Phalaris* spp., *Lolium* spp., *Alopecurus myosuroides, Agropyron repens, Hordeum murinum, Bromus* spp., *Poa* spp.. Also ubiquitous are annual and perennial legumes in some fields. They are less common in fields which have been deep-ploughed over the last decade. Discussed further in Chapter 6, all informants commented on the loss of flora in deep-ploughed fields.

Precipitation

> The irregularity of the soil surface . . .; the exposition of the 'place'; the nature, composition and other properties of the soil; the vegetation and state of cultivation; the presence of large bodies of surface water, stagnant or flowing, and the circulation of subterranean waters, influence the climate (and soil) independently of the actions of temperature and humidity (Viggiani 1931:510, my translation).

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[14] Some other plants I identified in fallow fields in the environs of Oppido, Irsina, and San Cataldo di Bella were *Fallopia* spp., *Urtica* spp., *Euphorbia* spp., *Portulaca* spp., *Chenopodium* spp., *Atriplex* spp., *Capsella bursa-pastoris, Sonchus* spp., *Cirsium* spp., *Myosotis* spp., *Ranunculus* spp., *Papaver rhoeas, Fumaria officinalis, Raphanus raphanistrum, Myagrum perfoliatum, Convolvulus arvensis, Galeopsis tetrahit, Anagallis arvensis, Lamnium* spp., *Solanum nigrum.*

These areas are climatologically Mediterranean. Annual precipitation varies significantly from year to year, and while annual totals typically exceed the 400 mm commonly used to define an area as semi-arid, characteristic of semi-arid zones is 'bi-seasonality' (Orshan 1983:87; Hobbs et al. 1995:11): winter precipitation and summer aridity, limiting the growing season to winter and spring. Important also is that during the coldest period (January), plant growth is at a near stasis, leading many researchers to designate both summers and winters as periods of plant growth stasis (c.f. Snaydon 1981:19). Consonant with my observations, Noy-Meir and Harpaz (1977/78:166) note that the first effective rains occur in November and December. Plant growth however, is slow until the end of January, and rapid through February and March.

It is a truism that the success of farming especially, but also pastoralism, depends upon reliably distributed rainfall. Many factors confound attempts to describe accurately actual precipitation values in the area. First among these is the extreme yearly and monthly variations measured at the various stations. For example, for the Potenza station, precipitation values diverged dramatically in the month of March 1993 and March 1994 (64.2 and 1.6 mm, respectively; unpublished data, Ufficio Idrografico e Mareografico, Catanzaro).[15] Furthermore, the extreme yearly and monthly variability measured at the various stations, does not capture local variations nor distribution of precipitation, where interseasonal distribution of precipitation is a primary limiting factor in plant production (Gutman 1978:227). In other words, total rainfall is less a predictor of success than its distribution over the growing season. In South Italy, as in mediterranean-type zones generally, rainfall occurs predominantly over the winter growing season, and summers are characterized by drought. This general rule is true when considering precipitation averages over the long term, trends which are evident in Figure 6 (for greater detail, please refer to Appendix C). General rules which are described by Caloiero et al. (1993:20-21) for Basilicata, show that precipitation varies with altitude and seasonally, as set out in the tables below (see Blondel and Aronson 1995:47, 49).

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[15] I gratefully acknowledge the assistance of Dott.Ing. Raffaele Niccoli in releasing to me these unpublished data, and Giuseppe Valentino of the Potenza Section for his help.

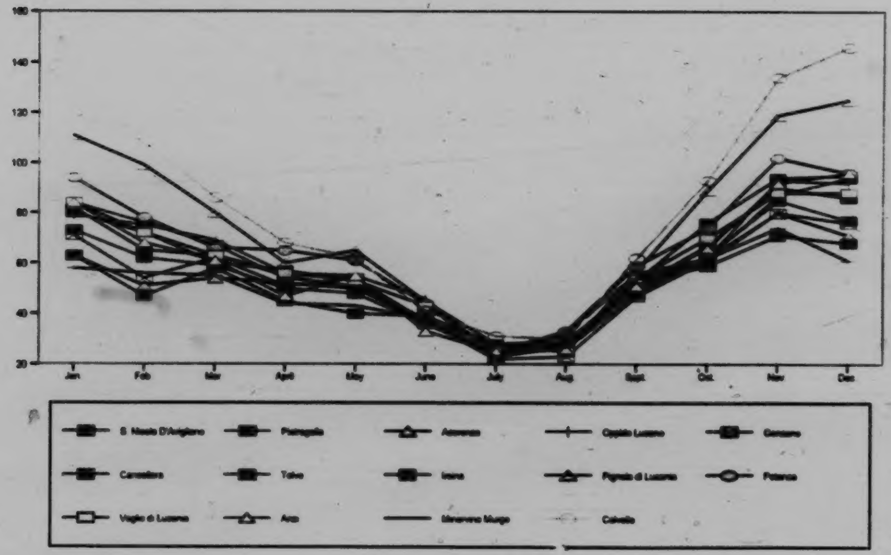
Table 3: Precipitation Variation According to Altitude (Caloiero et al.1993:20).

Elevation (m a.s.l.)	# Weather Stations	%	Av. m a.s.l.	Precip. (mm)	# Days Precip.
0-100	7	8	52	676	67
100-250	3	3	184	682	70
250-500	28	31	407	814	77
500-750	31	34	930	990	88
750-100	19	21	886	966	91
1000-1250	3	3	1043	868	90

Table 4: Monthly Distribution and Annual Average Precipitation in Basilicata (ibid.:21).

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Precip. mm	113	92	81	65	59	39	27	29	58	89	117	124	892
%	13	10	9	7	7	4	3	3	7	10	13	14	100
Days Precip	10	8	8	7	7	5	3	3	5	8	9	10	83
%	12	12	10	9	8	5	3	3	6	9	11	12	100

Figure 6: Community Monthly Precipitation Averages (1921-1980).

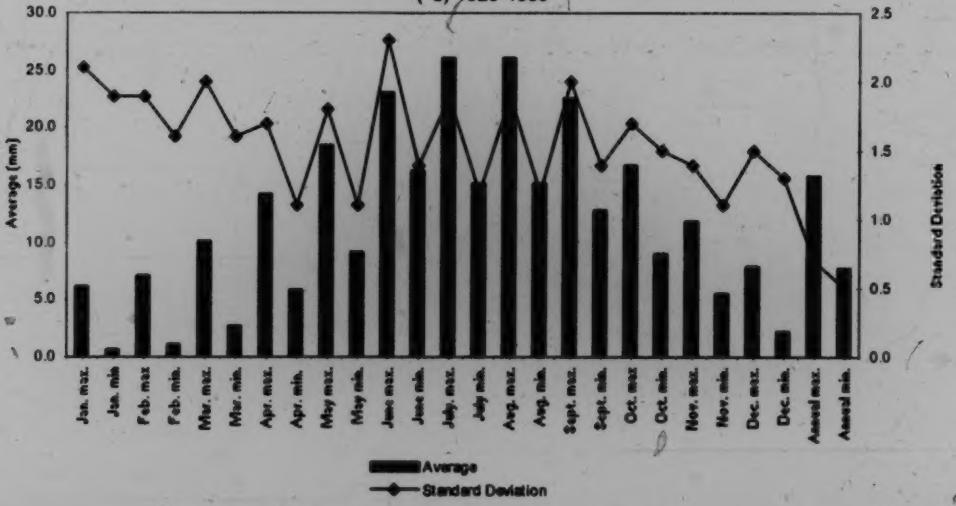


While the annual precipitation trend for winter rain and summer drought is the general rule southern Italy, oscillations in precipitation, and divergence from this norm are the most significant factors for agro-pastoralists in Basilicata. Meteorological data tends to be gathered with an eye to establishing patterns on a world-wide scale. Viggiani (1931:510) also points out that ". . . the median average annual and monthly values of temperature and humidity are gathered without accounting for certain factors extremely important from the agricultural perspective " (my translation). The summary figures and tables in Appendix C reveal the breadth of variability in precipitation from one month to the next, and between years. Whereas the trends of summer drought and winter precipitation are evident in the figures, obvious too is the variability which is so great in this area that precipitation averages have no predictive value (see standard deviation values in Appendix C Tables). As one Cancellara informant explained, the total amount of precipitation over the current year (which he estimated to be an abundant 1000 mm) was not indicative of the on-site reality of its periodicity. Rainfall is poorly distributed over the year with long periods of drought. Late summer - early autumn heavy precipitation ". . . falling on hot, dry soils is of no use for most plants and may have catastrophic consequences" (i.e. landslides) (Blondel and Aronson 1995:49). The same is not true of temperature: seasonal variation is predictable (see Appendix C for greater detail).

Viggiani (1931) reminds us of the principle at the heart of agro-ecology: "Productivity or return is not an absolute value, but results from a relationship between production capabilities and the resistance to environmental diversity" (Viggiani 1931:511, my translation). Informants identified the most significant factors that determined the success or failure of production over the course of a year. Their primary concern rested with amount of precipitation, particularly that occurring over the winter growing season. Ideal precipitation conditions included a good, early rain in September to soften the soils and hasten germination in pastures. Sowing fields with cereals begins in the mountains in October, and can continue at lower elevations in valleys until Christmas. Until sowing is complete, heavy rains are not welcomed because of the effect on the soils of too much rain makes ploughing difficult. Informants working lands at higher elevations noted that sowing at the elevation of their fields has to be undertaken under dry conditions because otherwise the seed is susceptible to frost and will not germinate. Once sowing is complete, then a good, heavy snowfall is welcomed on mountain and hill slopes above the valley.

Farmers (and *pastori*) rely upon winter precipitation and prefer snowfall to insure an accumulation of water at some depth in the soil for the spring growth period.[16] Informants emphasized that snow releases moisture gradually into the soil. Moisture consequently penetrates more deeply than an equivalent amount of rainfall which is particularly important on slopes because run-off is otherwise a problem (FAO 1971:5).

Figure 7: Potenza (Basilicata) Average Monthly Maximum and MinimumTemperatures (°C) 1926-1980



Snow is welcomed between December and February, but can occur later in the season at some altitudes and exposures which can damage growing cereals. During the winter of 1994, I was struck by the distribution of snowfall. In the Bradano Valley below Oppido, only rain had fallen whereas 100 m higher at *c.* 450-500 m a.s.l., a small amount of snow had accumulated, and each increment of 50 m in elevation added approximately 10 cm more snow, so that in Oppido at 700 m a.s.l., more than 50 cm had accumulated, a heavy, wet snow that dissipated within 5 days of having fallen. Heavy snowfalls do not occur annually in Oppido Lucano, whereas in the higher mountain communities of Abriola, Anzi, Avigliano, San Cataldo di Bella, Bella, Ruoti, and Vaglio, snow is an annual occurrence (although with exceptions),[17] predictably lasting up to two full weeks at the higher elevations, an important difference which shall be discussed below.

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[16] An Italian proverb, *"Sotto la neve pane, sotto l'acqua fame"* (Under snow bread, under water hunger), emphasizes the value accorded snow in bringing wheat to maturity, whereas rain holds no such guarantee.

> When rainfall is strongly influenced by convection (vertical air movement) due to surface heating (as in arid and semiarid regions), it tends even in normal years to be irregular and spotty (Jones 1987:158).

Distribution of precipitation over the course of the year is extremely variable as is its distribution across the landscape. *Pastori* and farmers alike spoke vehemently of the variability of precipitation within their farms/grazing lands and between farms. This was an essential point repeated to me over and over again. A good rain might fall on one slope and miss another entirely, and hail may demolish one field and not touch the next. Hail is particularly dreaded as it decimates vineyards, vegetable gardens and olive groves. In the company of a mixed farmer I had been interviewing, I watched with horror the pulverizing effect of a hailstorm, the second in the season and for the second consecutive year. It was the 21st of July, the storm laying to waste a vegetable garden and vineyard that had managed to recover from the earlier, spring hailstorm, reducing it to a hash of torn leaves. Aware that some producers purchase insurance, I asked whether the vineyard was insured. Unfortunately it was not, because drought is not a problem at that location (well water being plentiful), and secondly, the likelihood of hail recurring at the same location was slim. What I had witnessed was a freak incident, the storm clouds had appeared suddenly from the direction of Pietragalla, and within a few minutes had brought a deluge of hail across a slim strip of the south facing valley slope, also wrecking untold damage to *c.* 1000 olives trees. Not all was lost, however, because the family also cultivates land in the Bradano valley.

In town, news is rapidly transmitted about the location and effect of hail, the haphazard distribution of both 'good' and 'bad' precipitation occasioning resigned comments about the will of God, such as *"qui si aspetta che manda Dio la pioggia"* (here we wait for God to send rain). In Cancellara, the population holds that by ringing a particular church's bell whenever clouds that look like hail appear on the horizon, helps to ward off the storm. The inability to predict is a testament to the vagaries of precipitation generally, variability exacerbated by the dissected topography which confounds wind currents (vertical air movements). Nonetheless, the lack of predictability is mitigated by a complex, accumulated and intimate knowledge of the influence of elevation, slope, aspect and winds affecting each field or pasture.[18]

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[17] The massive snowfall throughout North, Central Italy, Sicily, etc., late December 1996 did not touch the Potenza area, only a few flakes of snow fell on the 26 and 27 December (informant, telephone communication).

Thus, most predictable are the effects of altitude and exposure which are fixed variables, serving as guides in decisions regarding which crops are best suited to certain locations. Basilicatans' use of micro-environmental diversity is illustrated by the manipulation of variable rates of crop and spontaneous plant maturation dependent upon aspect and elevation.[19] While these are constants, less predictable are the effects of winds upon actual positive accumulations of soil moisture. The effect of wind is a factor identified by informants as having a significant impact upon soil moisture and the benefit of precipitation. Especially in summer, the rate of evapotranspiration (a combination of heat and wind) can exceed what little precipitation has fallen (see also Koster 1982:201; FAO 1971:10). When I commented on a good rain in the late spring, through summer, my observation inevitably led to a sigh and shrug as local inhabitants observed that any positive effect was reliant upon an absence of wind. Croce (1930:32-34) too emphasizes in his description of South Italian agriculture and livestock, that precipitation must always be measured against the effects of predictable and drying winds to arrive at a more accurate evaluation of the actual soil moisture retained from any precipitation event. Croce (1930) describes the continental South Italian climate as arid-warm in the valleys and plains, mitigated in hill and mountain zones by the effects of altitude without losing, as he notes, ". . . its characteristic summer aridity" (Croce

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[18] This knowledge parallels that which Harding (1975:285) notes in passing of northeastern Spanish farmers' understanding of winds and their effect on precipitation.

[19] This variable and that of altitude, enter into decision-making -- the staggered maturation of crops eases problems of harvesting contemporaneously (c.f. Galt 1979 and Bailor 1976; Forbes 1976:238-239) and reduces risk from climatological variability. Lambert (1977 quoted in Isbell 1978:36), writing of Andean agro-pastoralism in the Andes arrives at the same conclusions:

> households based on nuclear families control productive resources . . . . strive to attain self-sufficiency, either through exchange or by securing direct access to land in several zones. Such vertical control also enables the group to utilize the labour of its members most efficiently, and provides it with some insurance against the disruptive effects of localized frosts, hailstorms, and excessive rainfall.

A climate dissimilar from that of South Italy prevails in the Andes, but parallels to the Apennine's diversity in micro-environments, based on vertical elevation extremes, are clear.

1930:32, my translation). "But the truly negative element of the region's climate is the wind. . . . . And along with the vegetation suffer men and animals, justly among us runs the saying <<*annata di vento annata di niente*>> (year of wind, year of nothing)" (ibid.:33-34). As Croce (1930:32) observes, communities in the interior have moister and cooler climates than those overlooking broad valleys like the Bradano. All, however, are subject to summer drought. This author presents the problem, well-understood by all informants, of the effects of winds on any positive precipitation because the largest proportion of soils are clay based. A deluge of rain will not penetrate the soils, but rather will wash down slopes, and may cause landslides or slumping. Abundant rain, followed by drying winds has little effect in enhancing soil humidity. Informants frequently indicated that particular days brought winds from predictable directions. In the Oppido area, informants identified three important wind patterns. Winds from the Adriatic bring moisture during the summer, and winds from the northwest and northeast carry moisture and cold during the winter. Winds from the south, the *scirocco*, especially, I was told, desiccated soils and cancelled any positive effects of precipitation. In mid-summer, local knowledge holds that these winds carry with them dust from North Africa, a yellow dust which was visible on parked cars in town. Informants' knowledge of winds and whether they bring humidity (from the Balkans in summer) or merely dry the land (from the Levant) is complex, and figures into their calculations of anticipated harvest results.

"Land is not treated as a homogeneous area, but as finely differentiated [. . .] as manageable, usable or otherwise in varying degree" (Hobart 1993:18). While this statement was made with reference to the Dogon (West African horticulturalists) (van Beek and Banga 1993), it can apply equally to Basilicatan informants who similarly classify lands according to the use to which they are suited, based on physical characteristics which are encapsulated in descriptions such as "a cool, wet field suited especially to growing vetch or beans".[20] Fields are thus identified according to the moisture and warmth of the field (dependent upon slope aspect and elevation), which determines crops selection. In a universal strategy of risk avoidance, farmers tend to distribute their crops (wheat, especially) across a variety of zones to reduce risk of drought and conversely, of frost. Those with lands subject to late spring frosts (damaging to developing grain heads) will also sow fields at lower, warmer elevations, with varying aspects. Concomitantly those warmer, south-facing fields at lower altitudes are more subject to drought than the fields at risk from late frosts. In so dispersing crops across the vertical gradient and with varying aspect, farmers manage their crops with one eye to mitigating against general crop failure and the other eye to varying sowing and harvest times.

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[20] Selection of crop locations based on the aspect of the terrain – north or south-facing, exposure to wind and availability of moisture. *Medicago sativa* (alfalfa), beans, carrots put in cool areas. Hard wheat put in the warmest areas, while soft (bread) wheat can go either in cool or warm zones.

Field fragmentation, the dispersed cultivation across the landscape, at different elevations, and at some distances from one another, flies in the face of industrial agricultural planning which advocates single, agglomerated, rationalized holdings (see Forbes 1982:324). Field fragmentation is attributed to the bilateral inheritance system, but revealing is the fact that most farmers continue to cultivate plots of land kilometres apart from each other rather than rent them. The author of a study of field fragmentation on the Island of Pantelleria off the coast of Sicily (Galt 1979), demonstrated that far from being disadvantageous, the scattered plots help to mitigate risk of total crop failure because of frost, hail and drought, while extending peak periods of intensive labour so that a single household can sow and harvest its own crops. With reference to the grape harvest,

> Field fragmentation and scattering throughout island ecozones has another important advantage in climatically bad years and in normal ones. Since grapes ripen at different times according to their relative location, harvesting proceeds serially, beginning in early August (sometimes earlier, sometimes later according to yearly climatic conditions) and proceeds through the end of September. With the help of his family, and perhaps a few man-days hired labor, a householder can harvest the crop from an average size holding over a period of a month and a half with little cash outlay (Galt 1979:102).

Forbes (1982:256, 282) arrives at similar conclusions in his study of Greek farming and further argues that the inheritance system which produces scattered land holdings is necessary under the conditions of production based upon household labour and to mitigate the effects of a highly variable climate (Forbes 1982:353-354). Land fragmentation in both Galt's (1979) and Forbes' (1982) analyses is a 'cultural coping mechanism' for risk management in a highly variable, unpredictable climate (see also Forbes 1982:324-326, 329; 1976:243-244).

The vertical gradient is extremely important to farmers and *pastori* for the conditions it imposes upon variable rates of plant development, considerations which shall be discussed in detail in subsequent chapters. Climate variation between communities also has important ramifications for the distribution of and demand for agricultural labour throughout the region. Informants defined communities on the basis of variations in climate -- that is, on the basis of the timing of harvests, differences which are marked between the cooler and wetter mountain communities and those in the plains towards Apulia, characterized by intense summer heat and greater aridity. Noted in passing in Chapter 2, the advent of tractors and combines marked the end of mass migrations of agricultural labourers from areas where the harvest had ended (in the hotter plains) to higher elevations to work on harvest teams (*paranze*). Agricultural labourers from higher elevations travelled to warmer zones to harvest while crops in their home communities were maturing. Now the same divisions hold, but migration for work is restricted to few individuals taking their combines from community to community. Similarly, on a local scale, owners of combines are contracted to harvest fields which mature at times different from their fields. In sum, informants differentiate fields they cultivate on the basis of relative position along a vertical gradient: on the basis of aspect, relative warmth and moisture, and on the basis of their cumulative experience -- the product of experimentation and the application of local knowledge -- to their crop selection. On a broader scale, these distinctions are applied across the local landscape and on an even larger scale, between communities.

Olive Groves and Vineyards

It is important here to comment briefly on the emphasis on olives and grapes in the scholarly literature describing Mediterranean farming. Mediterranean farming systems are typically identified by the cultivation of vines, olives and wheat (e.g. Barker 1985:82). In his review of Italian farming prehistory, Barker (1985:63) identifies mixed farming in the Neolithic to be based upon cereals, legumes and sheep: ". . . the subsistence data from the sites invariably consist of domestic animals, cereals and legumes" (ibid.:66). From the third through to the first millennium bc, ". . . there is little evidence for major changes in the agricultural base: the range of cereals, legumes and stock remained much as before" (ibid.:80). However, with the emergence of the Etruscan state system in the eighth century bc around Rome, and in the fifth and fourth centuries elsewhere in Italy, Barker identifies a change from mixed farming to "polyculture," characterized by the introduction of olives and vines:

> the 'neolithic' system of mixed farming based on cereals, legumes, sheep and goats was replaced by polyculture. . . . . . Although olives and vines were probably native to the whole region, the development of systematic polyculture took place only as part of the process when agriculture advanced beyond self-sufficiency (Barker 1985:82,83).

Barker's (1985) polyculture consists of the addition of olives and vines which he views as a structural change in the farming system, to arrive at his definition of Mediterranean farming since the Classical period as the ". . . cultivation of cereals, olives and vines, and stock-keeping concentrating on sheep and goats."

First, crops other than olives and grapes are customarily produced within South Italian farming systems. Secondly, subsidiary crop production responds to market demand. Informants reported to me changes in market crops over the last thirty years in response to fluctuating demand. For instance, one informant reported a change from tobacco to kiwi fruit; consumed by the household, but also cultivated for sale (Salerno, Campania). Similarly, figs, artichokes, tomatoes, cherries, apricots, almonds, pomegranates, etc., are consumed by household members, but where quantities suffice and a local market exists, these are also sold. They require different amounts of labour in household production for household consumption and for the market. Such crops are commonly cultivated among cereals, and frequently also serve to mark field (property) boundaries. Olive and grape production conceptually fit more readily into this type of production. Consequently, olives and vine production should be considered as adjuncts to a system rather than defining elements. These crops are incorporated in agricultural production in such a way that they do not impinge or detract from the symbiotic relationships integrating cereals, legumes and ovicaprids. The main system components are retained. Thus, olives and grapes would appear to be less a replacement than an addition to the system. It is therefore not clear that any structural change to the farming system occurred. This analysis is consonant with that of Koster (1977) in his analysis of traditional land use in the Greek Peloponnese where he states that "[o]lives and vines have played a variable role along with other crops in the past, but the place of cereals and sheep and goats has always been secure" (Koster 1977:148).

The emphasis in the literature on the cultivation of olives and grapes as characteristic elements of Mediterranean agriculture may be attributed to their prominence in the landscape and to the amount of labour their cultivation exacts in the course of the agricultural year during which significant household labour is dedicated to their cultivation. Other factors which may contribute to the significance given these particular crops: their processing and storage requires specialized tools and locales readily discernable in the archaeological record; and research geared to establishing macroeconomic patterns, trade networks and community specialization within state societies may have contributed to their prominence within the literature. While olives and grapes are characteristic Mediterranean crops, they are not integral elements of the dryland farming system described here. Their role in the system is restricted to the consumption of leaves and prunings during periods of fodder scarcity. In this role, they are not exceptional as spontaneous and husbanded vegetation can be used as fodder in a pinch (e.g. oak, spontaneous hay, straw).

CHAPTER 4

BASILICATA AGRICULTURE & PASTORALISM: AN OVERVIEW

In this and the following two chapters, I explore the information transmitted to me by *pastori*, farmers, mixed farmers and agricultural labourers during field work. Here I set out in detail seasonal farming and herding practises: the timing of sowing and harvesting, changes in grazing resources, different crop rotations, the various sown crops and the continuum of harvested and exploited forage and fodder resources. Also described to me and detailed in the following are the different methods of fertilizing arable land, the use of prescribed burning and controlled grazing, sheep and goat breeds, and the role of long-distance, horizontal transhumance. This descriptive chapter concludes with an account of changes, identified by informants, to have resulted from the introduction of industrial tools and agrochemicals.

Conceived as a comparative study of systemic relationships between farming and herding across micro-environments, I set out to compare farming and herding relationships in mountain communities at different elevations with those on the plains. Micro-environmental variation within a relatively narrow geographical range along the vertical gradients (elevation) establishes the basis for comparison across the range of elevations in each valley. The comparisons were designed to establish whether or not micro-environmental differences condition the basic infrastructure of dryland farming and herding. Such a comparative analysis assumes that farm systems are bounded units, restricted to a narrow geographical range -- a delimited elevation. Thus, I initially believed it possible to define elevation-bounded units within discrete portions of valleys, thereby establishing geographical limits. These bounded units in each community's territory would include the available vertical geographical gradient and might be based upon a catchment area.

Actual farming and herding practises rendered this untenable. First, most households, whether farming or herding, make use of the broadest micro-environmental range available. Consequently, households' production was found not to be confined to a narrow geographical range in elevation along the vertical gradient. Throughout Basilicata, the greatest proportion of farms are less than 50 hectares in size (see ISTAT records, Appendix A). Plots of one household may range from a small piece of a hundred or less metres square near town, to a 5-50 ha field in the valley and others scattered at various higher elevations with varying exposures. This fragmentation was and still is considered by most development workers, to be an index of 'backwardness' and an impediment to 'rationalized', 'modern' agriculture. Conversely, researchers (with whom I am in agreement) have argued for the value of holding properties in various locations and at differing altitudes (e.g. Galt 1979; Galt and Smith 1979; Forbes 1976; Forbes 1982). Discussed briefly in Chapter 3, the desirability of maintaining access to a broad range of micro-environments is held to be a primary factor in the continued cultivation of small, 'fragmented' plots by households along the breadth of the available vertical gradient (see also Forbes 1982; Galt 1979, Koster 1977, Lambert 1977 quoted in Isbell 1978). In brief, micro-environmental variability allows households to complete harvesting and sowing for instance, without requiring significant inputs of extra-household labour, because different elevations establish different rates of crop maturation. More importantly, plots of land scattered across the environmental gradient reduces the impact of crop failure on the cultivator in this area of extreme meteorological variability. This pattern of cultivation and herding across the vertical gradient renders untenable an analysis predicated on an assumed, geographically restricted household production unit.

Secondly, parallel elevations (and therefore micro-environments) exist between the communities studied (Figure 8), although the range of overlap varies between communities. The elevations of the highest and lowest communities do not overlap at all. Where informants use the broadest range available, and these ranges in elevation are partially duplicated from one community to the next, the anticipated diversity between communities and household land use on the basis of distinct micro-environments seems an irrelevant distinction. The figure shows a 6 km transect of the topography (3 km on either side of representative study communities) which illustrates the heterogeneity of the local landscape: high and low elevations are locally present and readily accessed within a half hour walk from the towns. The profiles also show how communities, for the most part, are located on promontories at upper, mid-elevations, with ready access to surrounding higher hills/mountains.[1]

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[1] Isbell (1978:36) notes a parallel strategy in the Peruvian Andes where communities are also found at mid-elevations allowing ready access by residents to the broadest range of micro-environments locally available.

Extremes aside, corresponding elevations (micro-environments) exist across communities. Given the use by households of a diverse range of micro-environments across the vertical gradient, and that significant overlap exists between communities' micro-environments, comparisons made solely on the basis of municipal jurisdictions do not produce meaningful results. Crumley (1994b:11) rightly counsels, "arbitrary boundaries around an area of study are to be avoided, except in the initial stages of investigation." She proceeds to note that "[a]dministrative boundaries do not nest with but overlap environmental, social, and economic boundaries" (ibid.:12). Her observations hold true for Basilicata. Consequently, I have chosen to amalgamate those data from similar micro-environments, across communities. More precisely, I have elected to draw together data from the communities into three categories broadly defined by elevation. Accordingly, the most mountainous zones include the largest portion of lands under the jurisdictions of Vaglio, Anzi, Abriola, Calvello, and San Cataldo di Bella ranging roughly from 800 to 1200 metres a.s.l.. In the mid-range elevations are zones encompassing the hills around and including Oppido Lucano, most of the lands under the jurisdiction of Cancellara, Ruoti in part, the hills above and surrounding Tolve between 500 and 800 metres a.s.l.. The lowest elevations (approximately 500 metres a.s.l. and less) include valley bottoms and the Bradano river -- most of the lands below Irsina, a significant proportion of the lands below Oppido Lucano, and parts of Tolve's jurisdiction and the environs of Minervino Murge (Apulia).
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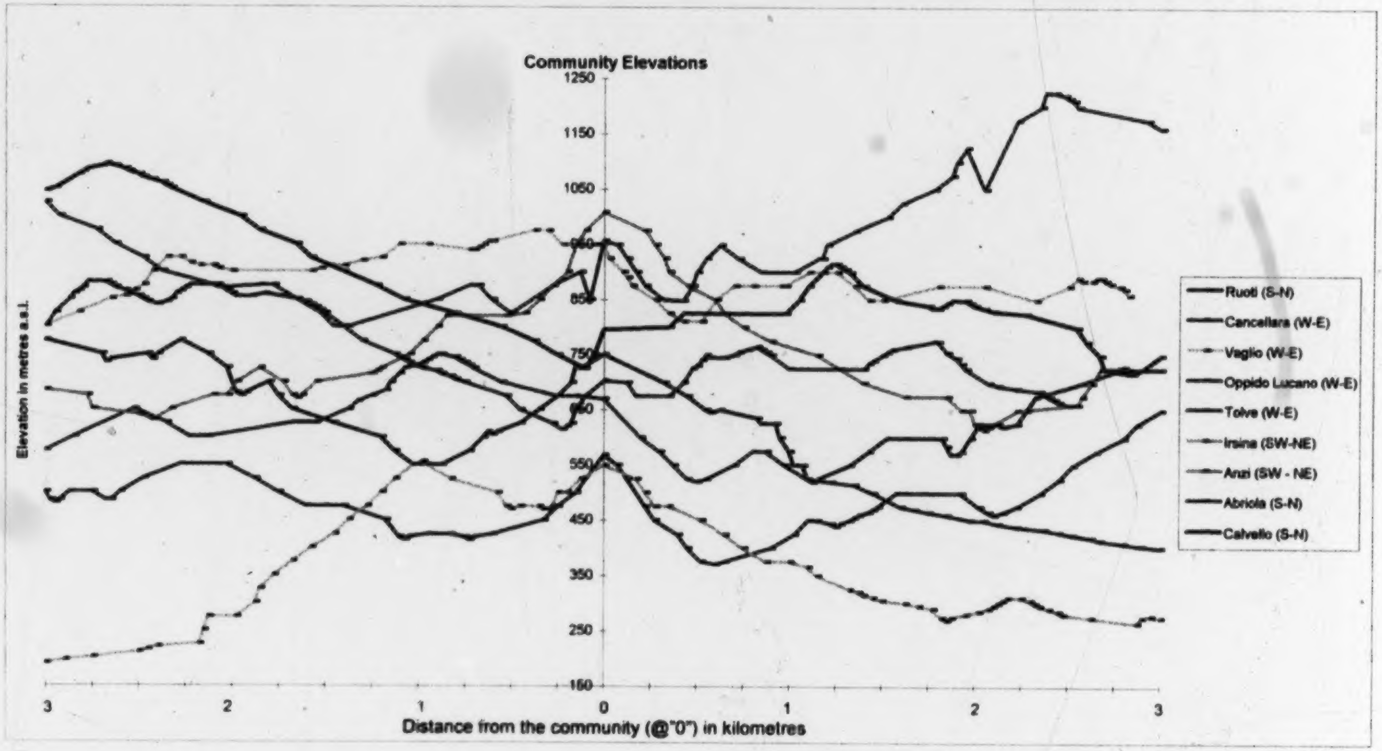
It is essential to keep in mind that most community territories fall into more than one of these three analytical divisions, and most importantly, that individual producers also cross these analytical divisions.

Figure 8: Community Elevation Profiles



What emerged is a consistency of practise across communities and environments. To avoid repetition, the general pattern is described with reference to variations on this common practise, particularly at the higher elevations and at the lowest elevations. Differences emerge, but are less extreme than anticipated during the formulation of the research.

In Chapter 2, I outlined the historical property arrangements in Basilicata. Worth recapitulating is the historical division between the propertied and land-poor classes within the communities visited. Until the land reforms of the 1950s, these divisions were largely unchanged from the feudal arrangements that dominated the South's history. In brief, *c.* 80% of the population worked as agricultural labourers or under sharecropping (*mezzadria*) contracts, others worked as tradesmen, and a small elite controlled the vast majority of arable lands. These lands typically were located in the valleys and agricultural and pastoral production were controlled by a bailiff. Each farm had flocks of at least 300 sheep (and included goats), which were tended by a hired *pastore*. Farming was carried out by a few hired hands and supplemented by day labourers hired from the towns, and during harvesting, from surrounding communities. The two branches of the production on a *masseria*, farming and pastoralism, were conducted separately, although the flocks play a central role in integrating the two, as shall be seen below.

Since the land reforms, in addition to the depopulation of the South through mass emigration, the landscape of ownership has shifted. While some informants asserted that very little has changed in that the propertied have managed to maintain the largest farms, the preponderance of past agricultural labourers and *mezzadri* (sharecroppers) are now also land owners, although on a smaller scale. Of these, almost all emigrated for work to North Italy, or outside the country to work in Germany, France or Switzerland. Upon their return, most purchased land to farm. In Appendix D, brief personal histories illustrate the changes that have unfolded over the last 40 years. Pertinent here, most informants have worked, and continue to work as agricultural labourers. At the same time, these individuals may have farm property which they work themselves, and may rent. *Pastori* who worked for the large landowners have been able to establish their own flocks thanks to land reform, the *Cassa per il Mezzogiorno* (development fund for the South), and European Common Market incentives. The majority of *pastori* have purchased arable lands and the equipment with which to work them, and have, by definition, become mixed farmers. However, they persist in identifying themselves and being identified by the larger community as *pastori*, and continue to produce milk and meat for sale. Below, I refer to them as "mixed farmers". It is also important to recall that all farming households keep a few sheep and goats for household consumption (meat, milk and wool), and kept other livestock (mules, horses, or oxen) with which to plough. Livestock in farming households are typically penned, and not taken to graze *"allo stato brado"* ("in the wild state" -- in the open). This is a central distinction between "mixed farming-pastoral" households, and farming households which are further defined by their focus of production on the sale of crops. The requirements for hay, feed and pasture were universal until the introduction of tractors (1950s).

Following is a descriptive synthesis of the information provided through interviews with farmers, *pastori*, mixed farmers, and agricultural labourers. I begin with a synopsis of the annual cycle of production and a generalized description of crop rotations. I then identify sown crops, the uses to which they are put, and changes in crops and crop use as articulated by informants. The strategies employed by *pastori* and how these are integrated with farming follows. Information supplied by agricultural labourers is incorporated throughout. Subsequent chapters (Chapters 5 and 6) explore this information with reference to technical reports and parallel practises in other regions. Significant differences, as shall be seen in the data below, occur only at the very extremes of elevations and precipitation.

Traditional Annual Cycle of Agro-pastoral Production

The beginning of the agricultural year is marked by the sowing of cereals and ends with the burning of cereal stubbles. Timing of sowing and harvesting varies according to elevation. Sowing progresses from the coolest to warmest environments, from the highest elevations and north-facing slopes, to south-facing slopes at the same elevation, from mountain to valley. The sowing and harvesting of cereals, and specifically wheat, is used an indicator of this staggering of the agricultural season across the landscape. In the mountains around Cancellara, about 800 m a.s.l., cereals are sown starting the last week of September, in mid-October at the mid elevations. At low elevations (warmest locations), cereals are sown from 10 November through

December and even into January.[2]

Table 5: Approximate timing of wheat sowing, growth and harvesting by elevation.

metres a.s.l.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.
800-1200	x	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xx	
500-800		x	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx		
200-500			x	xxx	xxx	xxx	xxx	xxx	xxx	x		

A Cancellara informant, asked about the differences between agriculture in the area of Cancellara and that of Oppido, noted a full month's difference in both the timing of sowing crops and harvesting -- sowing in Oppido occurs later and harvesting is undertaken sooner because of the lower and hence, warmer elevations. Further, the informant asserted, the Oppido area is topographically superior for cultivating cereals (rolling plains as opposed to steep slopes) and hard wheat grows better in the Oppido environs because of its lower elevation and warmer climate. Soft wheat (*Triticum aestivum,* bread wheat), on the other hand, especially the *Maionica* variety which is also called *"grano bianco"*, is grown more successfully in the environs of Cancellara, and is a noted mountain crop:*". . . si metteva esclusivamente nelle montagne"* (Cancellara, *c*. 75 year old sharecropping farmer). Like the hard wheats, it is sown in October and harvested in June-July.

Timing of crop sowing and harvesting in the more arid Apulian Murge, while low- to mid-range in elevation, is surprisingly like that of mid to high elevations in less arid environments. This may reflect a sample bias in that the *masserie* visited in March were subject to cold winds which would slow plant growth and maturation. In fact, the vegetation was noticeably less developed than that in the environs of Oppido Lucano and in the valley below the farms. Informants indicated that on their farms, wheat is sown in November, and harvested in July. Oats, leguminous hay and barley are all sown in October. Oats and barley also harvested in July, but clover (legumes for hay) is harvested between the end of May and the first half of June (depending on temperature and precipitation).

Crops are always sown earlier in the mountainous zones, and later at lower elevations, and conversely, harvested earlier at lower than at higher elevations. Barley grows better in cooler weather than the other crops and matures more quickly (Noy-Meir and Seligman 1979:127; see also Forbes 1982:268 for Greek parallel). Where it is not sown for winter grazing, but for seed, it can be sown later than oats, and as late as December at mid elevations. Here the only constraint noted by informants in the sowing of this cereal is that the weather must be dry, otherwise seed tends to be affected by cold.

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[2] Also during this period are planted garlic, peas and fava beans – all the seed legumes.

Oats and barley are sown immediately following the sowing of wheat fields, although this too depends upon field location (elevation and exposure) and on the anticipated use for the crop. *Pastori* prefer to sow earlier in order to extend the period of grazing. For example, at *c.* 600 m a.s.l. oats and barley are sown, if possible starting 15 September to October. Barley in particular, is also sown early (September) for pasture through the early winter months. The maslin (mixed) sown pasture and hay crop known locally as "*ferracine*" (*foraggine* in Italian), typically a mixture of barley, oats and a forage legume such as vetch, similarly is sown early, *c.* 15 September in the mid ranges.[3] With a bit of rain this nutritive mix serves as winter pasture for lactating sheep and goats, and for new lambs, kids, and weak adults. Informants emphasized that the maslin comprises not only these sown forage plants, but also all the spontaneous and excellent forage present in (warehoused by) the soil. By the end of December, they have grown enough to be grazed. Both are grazed from that time until the end of April. The grazing helps the plants to tiller, and if the year is too dry, the stunted crops remain as pasture (e.g. Oppido Lucano, 65 year old *pastore*).

In the Minervino Murge area, flocks are taken in to graze cereals, limited to 15-20 days maximum, and are also taken into fields of small fava beans and red clover (*Trifolium incarnatum*) to graze until the end of March.

The grape harvest was early the year I was there; white grapes were ready for harvest by October 02 at mid-elevations (*c.* 600 - 700 m a.s.l.). Typically, the grape harvest takes place during the second half of October. The end of November marks the start of the olive harvest which continues throughout December and January.

Lambing is timed for the market so that lambs are ready for sale at Christmas

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[3] Described further below, the *foraggine* appears to be a universal. While not extensive cultivators of perennial legumes for hay, the Minervino Murge *pastori* sow pastures (*foraggine*) composed of a maslin crop of oats, barley and clover for lambs, kids, sick and lactating ewes over the hard winter months.

(lambing occurring predominantly in October), and for sale at Easter (birthed February and March). Timing of lambing is controlled by restricting access of rams to the ewes (or restricting their ability to impregnate ewes by use of aprons, for example). The same timing and methods apply to goats in the mixed flocks.

The coldest winter months (January and February) are best for sausage-making. However, pigs may be slaughtered as early as December. This is because the olive harvest is in full force in January, and grape vines must be trimmed and trained during the same period. In February, sausage-making continues as does trimming the grape vines and planting and grafting new vines. The olive harvest ends in February. The most flexible and least bounded (from December through February) activity during this period is sausage production. Therefore, households will vary the timing of pig slaughtering and sausage making in order to complete sowing and harvesting which are calendrically more restricted activities.

"The old is finished and the new does not appear" (*"Lu vecchio è firnuto, ru nuove non pare"*) is said of the month of February. February is a lean period in grazing, and many producers have to supply hay and oats to their animals during this period or put them on a sown oats, barley or mixed hay pasture (*foraggine*) to graze.

Cereals which have emerged begin to be grazed in January, and are grazed until the end of March, beginning of April at mid elevations. Towards the end of April, mixed farmers and *pastori* begin to gauge the probability of crops' chances of attaining the height and head necessary for a reasonable yield, or whether they should be left for pasture. Again, timing of these activities shifts approximately one month earlier at higher elevations and one month later at lower elevations.

By March, vegetables begin to be planted (e.g. corn, beans and chickpeas), notable among which is the tomato, because it involves labour intensive harvest and processing during August. In amongst the olive trees fava beans are planted. Fava beans are also sown as a field crop (part of a crop rotation) or as fallow (green manure)[4] towards the end of October at mid elevations.

Hay which was sown at the end of October at higher elevations, and until December at the low elevations, begins to be harvested in May (at the lower elevations) through to the first weeks of June (at the higher elevations). Oats and barley also mature more rapidly than wheat and are harvested two weeks or so after haying is completed.

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[4] Described below, green manuring is the interment of nitrogen-fixing legumes as fertilizer, adding abundant nitrogen to the soil (Holte and van Keulen 1989:23-24).

Wheat begins to reach maturity at lower elevations the second week of June, at mid elevations during the beginning of July, and at the end of July at the higher elevations. Therefore, at higher elevations -- the bulk of lands in the Abriola township -- wheat sown in October is harvested in July. Hay in this area is harvested in June, whereas in communities such as Oppido where mid to low elevations dominate, hay is harvested beginning in mid-May and might be complete by the end of May, beginning of June. Cereal stubbles begin to be burned as early as July although 16 August marks the start of the legal period for stubble burning in all areas except Minervino Murge where informants indicated that 20 September is the start of the legal period for burning in their region. Sheep and goat flocks are grazed on the stubbles both before and after burning, until the fields are ploughed in anticipation of the next crop.

Basilicata Crop Rotations

> It should be emphasized from the outset that dry farming is of necessity extensive farming. Even with the best-known methods, crop yields are never high and not more than one crop per year is normally obtained (FAO 1971:3).

Across communities, Basilicatans identified the same, ideal crop rotation: a three year rotation comprised of wheat followed by either barley or oats, followed by a fallow year. Before the introduction of industrial agrochemical fertilizers, where soils were particularly fertile, a double or triple wheat crop was possible followed by a fallow year. Most commonly, however, the rotation was restricted rather than expanded, from three to two years, that is, to a single cereal year followed by fallow (*"Nei terreni miserabili era annuale: un anno si, un anno no . . ."*) (Oppido Lucano, 73 year old mixed farmer). In the Minervino Murge (Apulia) area, the traditional rotation is analogous to that of the less fertile areas of Basilicata. One year wheat is sown, the next year is fallow. Informants do not view this rotation as ideal, but rather as a necessary adaptation to weaker soils.

While the ideal rotation was the same in hill and plain, the actual rotation carried out varied where soils were poor. Less fertile soils tended to be those on hill and mountain slopes, as opposed to the relatively richer plain. Elevation, did not determine rotation. The growth period and variety of wheat sown, although soil fertility and to some extent, topography, determined the preferred crop rotation. Plains soils are said to have more substance and produce more. Some slopes could be ploughed, others were inaccessible to the plough and were hoed instead (*zappate*). The hill fields which were poor in fertility and difficult to work, were sown by broadcasting seed for hay composed of a maslin of wild vetch and sainfoin (*lupinella*), or fava beans, or small fava beans (*favini, favoudd'* in the local dialect, *Vicia faba* var. *Minor*), or chick peas, or chickling vetch (*Lathyrus sativus*).

Consequently, where possible, cereals were grown in a three-year maximum, one-year fallow rotation (Oppido Lucano 65 year old mixed farmer). Although more fertile soils could withstand three years' cereal, by far the most common rotation before the introduction of agrochemical fertilizers, was the one year of wheat, one of barley or oats, followed by fallow. The selection of rotation is made on the basis of soil fertility, but also on household needs, and especially upon the presence of livestock. For example, in the Tolve area, one of the wealthier households with *c.* 60 ha arable land in rolling plain (*c.* 500 m a.s.l., mixed farmers), follow the three year cereal, one year fallow rotation. Two years' hard wheat (sown usually early November), is succeeded by sowing either barley or oats at the beginning of October so that these supplement grazing during the winter months. The subsequent fallow year saw the arable either in bare fallow or sown in vetch for seed or a vetch maslin (with oats) for hay. The poorest soils could only be cultivated one year to cereal, one year fallow.

In the Irsina area, where the three year rotation of wheat, oats or barley, followed by fallow, was favoured, so too was the use of the "bare" fallow. Traditionally (*"prima, prima"*), the "bare" fallow served as pasture for mixed flocks in this area, the animals serving to fertilize the fields and weed them by their grazing. The area is dominated by large mixed farming estates on the broad, rolling Bradano plains, which were conducted under the *mezzadria* (tenant farmer/ sharecropper) system. In the Minervino Murge area, the bare fallow is also undertaken and when the year is "good" -- that is, when sufficient precipitation has fallen and the plant growth is abundant, part may be reserved from grazing after March to be cut as spontaneous hay. The selection of fallow reflects the presence or absence of livestock, the relative wealth (poverty) of the household, as well as soil fertility.

Throughout Basilicata, the fallow is the most variable element of the crop rotation. The fallow (*maggese* in Italian) is a rest period for the soil. It is most commonly understood by agronomists to mean setting aside a field for a year or so, either leaving the spontaneous growth until ploughing for sowing the following year's crop, or leaving it unsown and regularly ploughing under emergent spontaneous growth. Consequently, in its most common usage, the term refers to a "bare" fallow. Among Basilicata informants, the fallow is conceived more broadly; including the "bare" fallow, a number of other, sown fallows are also identified.[5] These all have in common a legume component, the cultivation of which is a recognized means of enhancing soil fertility. The fallow might take the form of a sown legume crop turned under to fertilize the soil, a 'bare' fallow which is ploughed but not sown, and left "bare" except for the spontaneous growth. Other fallows include maslin (mixed) crops of hay in which forage legumes such as vetch or clovers are the main component, sown in with oats or barley. Sown pastures of perennial legumes such as sainfoin (*lupinella*), Italian sainfoin (French honeysuckle, *sulla*), or alfalfa, also appear as fallow. Finally, what I term the legume-based 'garden' fallow, while undertaken by all households on a portion of their lands, is used almost exclusively as fallow by the land-poor.

Distinctions must be made not only on the basis of different elevations at the disposition of households and relative soil fertility, but also on the basis of relative wealth -- between the land-poor and the propertied. Choice of crops and decisions about type of fallow to pursue are largely determined by the amount of land held by a household and economic necessity. Patterns in choice of fallow emerge. For example, cultivating oats and barley was described by informants as dependent upon whether or not a household had livestock sufficient to require their cultivation. If a household simply had a mule and a goat, these were (and are) typically fed straw and spontaneous hay only. In these instances, wheat replaces oats and barley in the rotation -- a typical rotation among the land-poor where the soils will sustain it, is two years' wheat followed by a legume-based fallow crop for seed.

An important observation with reference to rotations is that the intervening periods between sown crops are also important. No matter what the rotation, the spontaneous growth emerging between harvesting and stubble burning, and after the burning of stubbles and sowing, for example, is always grazed by livestock. The arable is a source of forage for grazing animals for the greater part of the agricultural year, even when arable land is sown.

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[5] The root of the term fallow in Italian, *il maggese*, is *maggio*, meaning May and is linked to the hay fallow (*fieno maggese*) -- the hay is cut in May. The "bare" fallow, known as *maggese crudo*, or *maggese nudo* (the local dialect form is feminine -- *la maggese cruda/nuda*, etc.), is tilled, but not sown. The "dressed" fallow (*maggese vestito*) is a sown hay/forage fallow. The *maggese intero* or whole fallow is a year long, as opposed to the *mezzo maggese* or half fallow, which is a six month fallow (Zanichelli 1970:990).

In sum, scarce land resources are also reflected in a household's cultivation of legumes in fallows for seed (for sale), the absence of 'bare' fallow, sown hay fields, and the use of ash and night soil for fertilizer. Among land-poor households there is also a greater frequency of consecutive cultivation of wheat until poor crop yields force a fallow break.

The Legume-based 'Garden' Fallow

Until recently, the greatest proportion of the population throughout the communities visited held little land, and informants emphasized that land-poor households could ill-afford not to collect a harvest during the fallow year. For this reason, the most common fallow of the land-poor was a legume-based 'garden' fallow. Among the Cancellara poor, the 'bare' fallow was undertaken only when there was no other seed which could be sown, and then served as pasture. Land-poor Cancellaran households did not use green manure because they had little land and what they sowed, they harvested (*"i terreni erano pochi e quello che si piantava si doveva raccogliere"*) (Cancellara, 61 year old farmer). This type of fallow involves sowing various vegetable crops for market sale, animal feed, and household consumption. Typical crops are fava beans of both small and large varieties, corn (*Zea mays*), potatoes, green beans, peas, lentils, *cicerchie* (*Lathyrus sativus*), and chick peas (*Cicer arietinum*) among others. Consequently, in the Tolve area, the legume-based 'garden' fallow (*Vicia faba; Cicer arietinum; Zea mays; Lathyrus sativus; Lens culinaris*) was reportedly used by those with little land (1-2 ha), and was the most common fallow reported in Calvello. The flexibility of the use to which these crops might be put was pointed out by Calvello informants -- *cicerchie*, lupins, fava beans, chick peas, and lentils served for human food, livestock and chicken feed, or could be grown for sale as seed for green manure. The designations of forage, feed and food, serve only to describe the use to which a crop is put in a particular instance, and many crops may be used simultaneously to more than one end: ". . . the only clear distinction between forage and food legumes lies in the mode of their utilization in any particular situation" (Jones 1990:198).

Throughout the communities, regardless of relative land wealth, the fava bean (*Vicia faba*) in particular was traditionally extensively cultivated in this fallow, serving as both food and feed, the straw kept also as fodder. The whole plant is harvested by uprooting (*stirpare*) leaving only a few leaves on the ground and an occasional root system. Even though removed almost entirely, the nitrogen-fixing properties of the plant enriches the soils and improves productivity in following wheat crop.

The crop rotations in the environs of San Cataldo, Ruoti and Avigliano (hereinafter referred to only as San Cataldo) illustrate well the more intensive use of land by poor households. The greatest number of informants described a two course crop rotation of cereal followed by fallow followed by cereal. Despite this fact, where land fertility permits, informants indicated that the traditional system which dominates in most parts of Basilicata prevails in the environs of San Cataldo as well. In other words, while most of the land under cultivation in the San Cataldo area typically is sown to cereals one year and to fallow the next, some plots of land will sustain the rotation of wheat followed by oats or barley and then put into fallow. Thus, the pattern holds true also for this area of highly fragmented, small parcels of more intensely cultivated land.

The primary fallow type described in this zone was the legume dominated garden-type fallow. In the San Cataldo area the most important crop from the point of view of each household was corn (*granone*). Described in Chapter 2, prior to the 1950s land reform, the preponderance of the land was own by and managed for a handful of families. The bulk of the local population worked as agricultural labourers *(braccianti agricoli)* for tenant farmers or were themselves tenant farmers *(mezzadria)*, or held salaried positions on the larger farms. Any wheat grown went directly to the landlord or was sold. Very few could afford to keep back even a tiny portion for their household use. As a result, nearly everyone ate bread made of corn, and cultivated enough fallow land to corn for their subsistence needs.

This corn fallow is traditionally combined with the cultivation of a number of other crops, dominated by legumes -- i.e., the legume-based 'garden' fallow. The most commonly sown are beans *(Phaseolus* sp.*)*, chick peas *(Cicer arietinum)*, peas *(Pisum sativum)*, fava beans *(Vicia faba)*, and a small fava bean *(Vicia faba* var. *Minor)*, used primarily as a green manure and for feed. Potatoes were planted in the most fertile areas, whereas the legumes were reserved for the *terreni scarti*, the weak soils. Some people put in lupines or *Lathyrus sativus* (chickling vetch/grass pea), lentils for their household use in addition to cabbages, tomatoes, zucchini and so on. Not all of these are planted or sown at the same time in the same area. Common beans *(Phaseolus vulgaris)*, for instance, are sown in May, after the other crops have been put in and some even harvested. The various crops are sown in patches, some in one small piece of land, others elsewhere, scattered amongst the fragmented property.

This fallow shares some characteristics with the bare fallow since most of these crops are put in between March and April. Therefore, between the wheat harvest and burning of the wheat stubbles in August, the fallow fields are neither planted nor sown until March or April. During this intervening period, spontaneous wheat growth from fallen grain heads, the spontaneous forbs, legumes and grasses that emerge post-harvest and stubble burning, serve as pasture.

In areas dedicated later to broad beans, chick peas and lupines for instance, only those necessary for the household requirements and for feed were harvested, the other plants were turned under as green manure. Lupines and broad beans (both large and small varieties) served most often as green manure. Those broad beans harvested for seed would be pulled, but the leaves were stripped from the plants and left on the ground to be hoed under.

Green Manure -- *La Sovescia*

Use of legumes as green manure has an ancient history, and is a practise well documented by the agronomists of antiquity (Chapter 6). The extent of the use of green manure (the interring of whole nitrogen-fixing legumes for fertilizer), known as the *sovescia*, also reflects the relative wealth of households.

> Small fava beans [*favini*] are sown in November for green manuring, when the soil has lost fertility. March-April, the plants are turned under. The plants must not be completely ripe, but the seed must have formed -- not ripe, just formed (Oppido Lucano 70 year old mixed farmer, translated).

Among land-poor households, the small fava bean (*Vicia faba* var. *Minor*) was used in a limited *sovescia*, in vineyards or where potatoes were to be planted, the green manure turned under with a hoe. Green manuring on a more extensive basis was undertaken only by propertied households (*"Tutti quelli che mettevano favini [per sovescia] avevano terreni assai"*) (Tolve, 55 year old mixed farmer). Similarly, in Oppido Lucano, green manuring on an extensive basis (that is, beyond vineyard and olive grove) was undertaken by the wealthier households with sufficient land to set aside production, while those with little land used fava beans for food and feed, and small fava beans (*favini* ,*Vicia faba* var. *Minor*) for pig feed (Oppido Lucano, *c.* 60 year old *pastore*). Both limited and extensive green manuring are undertaken where the soils are weak (Tolve 60 year old mixed farmer). The weaker soils in the environs of Minervino Murge (Apulia) are reflected in the use of the *sovescia* with small fava beans for fertilizer today and also reportedly, in the past.

Noteworthy are the multiple uses of even a single plant during any season. The fava bean is not simply food, forage, green manure or feed, but all of these. The same plant may perform a number of these functions within a single fallow rotation. While not all legumes have the breadth of usages that fava beans possess, lupine and chickling vetch (grass pea, *cicerchia, Lathyrus sativus*) also share all these possible applications. At Anzi, small fava beans were used almost entirely for green manuring, a common practise in the area, and frequently entailed also the use of both small fava beans and common vetch (*Vicia sativa*). This is considered a true *sovescia* -- the crop is neither grazed nor cut for hay, and the whole plant turned under while still green.

Perhaps because of the small size of fields in the San Cataldo area and their more intensive cultivation, the practise of green manuring prevails here more than anywhere else in the region. Green manuring is now largely restricted to vineyards and olive groves for the most part. Informants who do plough under whole legume plants (almost exclusively the small fava bean) note that this is a difficult task for tractors as the plants grow quite tall. In the S.Cataldo area, a large portion of the plots are of a size which does not allow the economical use of tractors. These plots commonly are cultivated with a hoe (*zappa*) which is also used to break up and bury green manure.

In the environs of Irsina, informants asserted that an inverse relationship exists between the use of the *cortiglia* (penning the animals overnight on fallow fields to fertilize with their faeces and urine, see below) and green manuring.[6] Where sufficient animals prevailed for the *cortiglia* to produce abundant fertilizer, green manuring was unnecessary. Among the mixed farmers interviewed, green manuring had never been undertaken because there were always sufficient animals. In other words, where there were sufficient animals to undertake the *cortiglia*, there was no need to use green manure.

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[6] Used especially by large landowners who kept large flocks, the *cortiglia* typically involved using hired labour (i.e. *pastori*).

Among the land-poor, green manuring was limited to interring failed legume crops where they stand, so that those fields would at least produce a good crop of wheat the following year. The land-poor also restricted green manuring to small fields of up to half a *tomolo* (0.2 ha) where they intended to put in potatoes, and also in the vineyard and olive grove. While the poor typically harvested the seed from legumes, plant leaves were left in the field and turned under as a partial green manuring (Oppido Lucano, 72 year old agricultural worker). Another informant noted that *sovescia* more necessary in the mountainous terrains where the soils wear out: *"... i terreni si consumano in montagna"* (Cancellara, 62 year old farmer). However, one informant bluntly commented that the poor rented land and rented land would be exploited to the maximum, and consequently, there was no investment in green manuring (*"Terreno in affitto, cosi non si usava la sovescia, ma si sfruttava al massimo"*) (Oppido Lucano, 67 year old land-poor farmer). Irsina area informants also denied using green manure (practising the *sovescia*). The legumes most commonly used as green manure (*Vicia faba* var. *Minor* and *Vicia sativa*) in Irsina were grown for hay, the small horse bean also for feed -- the seed to be ground as an constituent of *sfarinato* (milled animal feed). In fields in the Cancellara-Tolve area, a number of fields had been sown to the small fava bean to produce seed for sale.

The favoured plants for green manure were these small fava beans (*Vicia faba* var. *Minor*). Large fava beans (*Vicia faba*) were not used as green manure, except in vineyards and olive groves. Common vetch is also reported to have been and remain a valuable green manure: *"La maggese della veccia è stupenda è molta ricca d'azoto"* (Tolve 60 year old mixed farmer). In Cancellara, all informants reported the past use of another vetch, locally called *faffarone* (*Vicia* sp.), typically grown for green manure and less commonly for seed for sale and for feed. Despite the use of botany reference books when conducting interviews to establish the identity of this vetch, appealing also to botanists and agronomists from both the universities at Bari and Potenza, its identity was never clearly established. This vetch is described as more bitter than the small fava bean, its seed shaped like that of a small vetch and grey-black in colour, the flowers violet and abundant -- up to 40/plant and therefore *c.* 40 pods/plant in a good year. The pods are described as long (*c.* 5 cm) and contain 7-8 seeds/pod. Like the fava bean, *il faffarone* was a favoured green manure in vineyards, the whole plant always interred for

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green manure.

Many informants never undertook green manuring fields, but most used this method of fertilizing on a smaller scale, such as in vineyards. As was the case with any conversation having to do with green manure, the topic became one of how the whole plant (legume) was interred. A Cancellara informant explained that before 1910, the wooden scratch plough or ard *(l'aratro a chiodo)* was the only plough in use, and plants were interred by hoe. It was only after 1910 that the iron plough, *Il Birbante*, gained currency -- a large iron plough used for the *sovescia*, although most informants reported using exclusively the hoe. On a more extensive basis, informants described the *sovescia* being undertaken on the plains using two to three mules and a special plough with two front wheels. Because these plants grow tall, they can only be turned into the soil on relatively level ground. For this reason, they were typically not used on extensive (large) hill slope fields (Oppido Lucano 74 year old farmer).

A *sovescia* which requires the interring of the whole plant at its peak of development, but before the seeds are mature, is understood by all informants to be the "true" or genuine practise. However, interring of plants after seeds have been removed and the interring of hay stubbles are also viewed as forms of *sovescia*, albeit partial forms. For example, in the Cancellara area, a partial *sovescia* was undertaken soon after having cut hay, the informant acknowledging the value of legume straw and roots to the following crop. Like the distinctions made between sown hay and spontaneous hay, bare fallow and top seeded fallow (below), the product or effect -- the functional role of the plants within the crop rotation is the more meaningful distinction. Every actor (farmer, mixed farmer, *pastore*) chooses from a continuum of options the selection of which varies according to such factors as seasonal challenges of an economic and climatological nature, soil fertility and availability of pasture and arable.

Bare Fallow

The land-poor tended not to sow pastures to a legume fallow of sainfoin (*lupinella*), Italian sainfoin (French honeysuckle, Spanish sulla, *sulla*), clovers or alfalfa. To these households, setting aside (out of alternate production) a field for 3-5 years under one of these perennial pasture legumes did not make sense. First of all, given the number of animals owned, it was not worthwhile because these animals could be sustained on the vetch, oat, barley and wheat straw saved after the seeds had been threshed. This fodder was supplemented with "wild" plants cut selectively for the livestock. Leguminous hay was a crop grown by the propertied rich who had land and animals in abundance. Thus, the greatest proportion of households made do with spontaneous (wild) hay, plants cut from beside the roads and paths and straw. Secondly, they preferred to put in a crop which they could both use and sell seed.

The bare fallow is universally practised among those with sufficient land to set aside a portion from production.[7] While the fallow is the most variable element of the crop rotations in Basilicata, it is also an index of relative wealth. The designation of 'bare' fallow is misleading in that spontaneous plant growth is grazed by mixed flocks and may be protected from grazing late spring for later harvesting as hay. Alternatively, the bare fallow might be top seeded with other forage to augment the spontaneous growth.

Stubbles leading into a bare fallow are not burned. The bare fallow is favoured in the Cancellara area for fields with abundant spontaneous growth, especially of *"trifogli selvatici"* (annual medicks, *Melilotus* sp., clovers).[8] In describing the seeds of these spontaneous annual legumes, universally descried were the effects of deep ploughing on spontaneous fallow plant growth. One mixed farmer explained the growth cycle of spontaneous, annual medicks, valued fodder and forage:

> It is a seed which must be buried shallowly. Now it is no longer found. It emerged first in the oat stubbles, in the soils subject to *"trifoglio selvatico"*. In February, after the animals no longer entered (to graze), it grew to almost a metre in height. We kept the animals out in order to allow this spontaneous hay to grow, and then cut it in June (Cancellara, 71 year old mixed farmer).

In this case, the informant was referring to the annual medicks *Medicago scutellata* (snail medick) and *M. orbicularis* (flat-podded/button medick), and the bare fallow is described as being used in soils which produce "too much" spontaneous growth (*"una*

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[7] The period of my stay in the area, marked the final year of the popular EEC five year "set-aside" fallow program. The program was designed to remove lands from wheat cultivation and to keep these lands in a 'bare' fallow while landowners/farmers were subsidized at the same levels had they been producing wheat.

[8] Informants universally identified legumes according to leaf shape, resulting in the grouping of clovers with medicks, birdsfoot trefoil (*Lotus corniculatus*) and melilots, peas (*Pisum* sp.) with vetchling (*Lathyrus* sp.), and all vetches (*Vicia* sp.) with milk-vetch (*Astralagus* sp.), for example. Excluded from this classificatory system is the perennial medick *Medicago sativa*, its spontaneous relative *Medicago sativa* var. *falcata* (*"lu nierv"*), sainfoin (*Onobrychis* sp.) and Italian sainfoin (*Hedysarum coronarium, "sulla"*), although *"sulla"* is also referred to as *"trifoglio per fieno"* and *"trifoglio rosso"* (clover for hay).

terra che menava tropp'erba"). Based upon hay needs and availability of good grazing elsewhere, the field might be protected from grazing altogether and harvested for a more abundant crop of spontaneous hay in May-June. The most valued spontaneous plants in such a fallow are wild oats and medicks (annuals and the perennial *Medicago sativa* var. *falcata*). Wild oats are considered to be excellent forage for grazing animals which emerges especially after rains have fallen on burned stubbles (*". . . la migliore erba per gli animali -- esce quando piove nelle restoccie bruciate"*) (Oppido Lucano, *c.* 60 year old *pastore*).

Spontaneous Hay

Whether from bare fallow or untilled lands, spontaneous hay was universally collected by households.[9] Conceded above, past spontaneous growth in fallow lands was abundant because of shallow ploughing, the absence of herbicides, the larger numbers of livestock and use of their manure to fertilize arable lands. For the land-poor, spontaneous hay was essential as such households could not afford to dedicate fields to sown domestic varieties. A significant distinction was made by informants, between spontaneous plants and "domesticated" varieties: paraphrasing one informant, "[spontaneous plants] are children of the soil, whereas wheat [and other domesticated crops] are stepchildren to the soil" (Cancellara, 84 year old mixed farmer).

> "But what destroys wild seed! No one, not even the Eternal Father who created the children of the soil!" (*Ma che distrugge lu seme selvatico! Nessuno, 'cca manche lu Padre Eterne che l'ha criate chi figli alla terra"*) (Oppido Lucano, 60 year old mixed farmer).
>
> "The grass which is a child of the soil -- all those wild grasses, vetch, *Lolium*, wild oats, *sulla*, wild clover -- all are children of the soil which came wherever one burned and also in untilled lands. The soil sends forth all types of grasses . . ." (*"L'erba che è figlia della terra – tutte erbe selvatiche, la veccia, lu sciuoill', lu*

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[9] Harvesting of spontaneous hay from both untilled pasture and fallow land is a common practise where Basilicatan mixed farmers and *pastori* identify valued fodder plants, and protect these from grazing until they are cut for hay. A similar practise is described by Forbes (1982), although he suggests that this is a departure from traditional practise.

> Uncultivated land seems to be left ungrazed and the resulting flush of grass in the spring is cut for hay. This phenomenon results directly from the general 'running down' of the agricultural enterprise in this village . . . and the consequent large area of uncultivated land (Forbes 1982:102).

A fragment of text also apparently refers to collection, harvest and storage of spontaneous ("weed") growth for hay in Iron Age Israel (Borowski 1987:35, 162).

> *gralite, la sudd', lu trifoglio selvaggio -- tutti figli della terra che venivano dove si bruciava e pure nei terreni incolti. Il terreno menava tutte razze di erba . . ."*) (San Cataldo, 70 year old mixed farmer).

The soil is a seed storing protagonist (*"Il terreno conserva i semi, è un magazzino"*) (Oppido Lucano, 64 year old mixed farmer), "the soil protects these [annual medicks], its children" (*"la terra protegge questi figli sui"*) (Cancellara, 84 year old mixed farmer) and has properties which favour these plants (Cancellara, 69 year old farmer). The value of these soil-husbanded, spontaneous plants is universally acknowledged, and informants identified particular plants to be especially valued for hay and grazing.[10]

With reference to hay requirements, the information gathered through interviews from mountain to plains communities (along the vertical gradient) revealed differential requirements for stocking hay. Hay reserves assume a negligible importance at the lower elevations, particularly along river courses and in forested zones, where snow is unlikely to fall, or to accumulate for more than a day or two, and the winter temperatures remain warm enough to assure at least limited plant growth (as opposed to stasis) throughout the coldest period (Oppido Lucano, 58 year old *pastore*).

In the Irsina area, along the Bradano river, this untilled zone produces abundant forage year-round. In this location, livestock can graze year-round as there is no accumulation of snow and very few days are too cold and wet to graze pastures. The rich flora of the Bradano river course also relieves the need to cut hay from fallow, and reduces the problem of seasonality in pasture resources. Consequently, there is no real need for supplementary feed, even in winter. However, for higher productivity year-round, sheep and goats are now given oats and barley, as well as hay.

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[10] Informants noted that selection for spontaneous hay from fallow fields was determined by the presence of these plant species and their relative abundance. Representative samples collected indicate that spontaneous hay harvested from cultivated fields tends to be dominated by grasses and forbs, but with a lower frequency of legumes than that harvested from untilled land. This may well be a reflection of the trend indicated by informants, of the long-term impact of deep ploughing and herbicides on the field flora. Species present in a representative sample of field harvested spontaneous hay: *Alopecurus myosuroides, Phalaris minor, Avena sterilis, Hordeum murinum, Lolium rigidum, Lolium perenne, Papaver rhoeas, Malvacaea, Medicago orbicularis* and a number of composites and crucifers (in a descending order of frequency). The field had been sown to barley, the stubbles burned and then left fallow and grazed until the middle of May after which it was harvested as hay in June. Another sample, from a spontaneous untilled, and more mountainous zone near Cancellara was dominated by *Lathyrus ochrus, Medicago scutellata, Phalaris minor, Avena sterilis, Lolium italicum,* and an assortment of composites and crucifers parallelling those found in the plains field, Oppido sample. Again, selection as hay was based upon the species present and their density, in this case, the wild peas and medicks were the prime species sought.

Conversely, at the higher elevations, hay and fodder of all sorts are stored, and are essential to maintaining livestock (Plate11). As is the case of San Cataldo di Bella, fodder from all possible sources was collected and stored for winter in the Calvello area. Seasonally available fodder such as olive trimmings were collected and fed to sheep and goats. Straw, though not much used, was kept to feed sheep, corn leaves were used for all livestock and oak trimmings were also collected for fodder.

In the Calvello area spontaneous hay was used for animal fodder, rather than cultivated hay. This was the general practise throughout Basilicata, because of the absence of mechanized harvesting and the logistical problem of harvesting sufficient sown hay (which matures en mass in fields) before the crop spoiled, which in large fields would require extra-household labour to harvest a hay field. Calvello soils are reported to be rich in spontaneous legumes -- some areas so thick with vetch that mules apparently had difficulty passing. Lots of spontaneous medicks and clovers as well as wild peas and oats were identified as the important components of spontaneous hay. This hay was cut in bare fallow as well as in untilled pastures. A universal practise in Basilicata, where growth is thick of spontaneous plants -- in fallow and untilled grazing lands, and especially where a near monolithic stand of legumes and grasses of high forage value are found, these are cut for hay.

Among valued spontaneous forage plants, a Cancellara area, land-poor informant (6 ha) identified the perennial medick, *Medicago sativa* var. *falcata*. Although rarely found in arable lands today because of deep ploughing, in the past it was always found in the fields, particularly in "red clay and "mixed" soils", and was cut and taken for hay. Known as *"erba nierve"* or *"lu nierv'"* it is described as similar to alfalfa (*erba medica*), but with narrower leaves, is deep rooted and resistant to drought. The root systems gave problems when ploughing because they were cut only with difficulty by the plough (Oppido Lucano, 80 year old agricultural labourer).

Also identified as cut for hay is Italian sainfoin (*sulla*, *Hedysarum coronarium*), which grows spontaneously in the area and is considered excellent fodder. An 83 year old *pastore* from the environs of Oppido Lucano identified among the spontaneous vegetation, the perennial medick, alfalfa (*Medicago sativa* var. *falcata*) and *sulla* (Italian sainfoin). Of the annual medicks, the "barrel" varieties called locally *"trifoglio arrotolle"* (both *Medicago orbicularis* and *M. scutellata*) are recognized as excellent, low growing fodder and cut whenever encountered for hay, as were varieties of burred medick

(*Medicago polymorpha, M. minima, M. truncatula*).

Wild medicks were identified from samples taken to interviews (e.g., *Medicago scutellata, M. polymorpha*) and acknowledged to be excellent pasture plants along with wild vetches (*Vicia* sp.). These and wild oats (*Avena fatua*) were noted to be resistant to fire, identified as excellent pasture that rapidly emerges post-burn, although another informant noted that wild oats are only good when they are small (*"Non è buona per niente eccetto quando è piccola"*) (Oppido Lucano, 70 year old agricultural worker).

Hedysarum spinosissimum, a spontaneous variety of *sulla*, was also identified as a luxurious legume consumed voraciously by livestock both when green and when manure. Spontaneous varieties of sainfoin, naturalized from domesticated populations are also common and are noted by informants to be favoured by cattle, particularly when mature. Spontaneous annual medicks are also reported to be consumed voraciously when mature.

According to one informant in the Tolve area, these medicks are sought out by Podolian cross-breed cattle as they graze, a claim substantiated by the abundance of whole pods found excreted in the cattle dung. These cattle selectively consume what the informant termed wild grasses,[11] in particular, vetches which are especially sought out by the animals when they in seed; wild *sulla* which is said to be deluxe (*"di lusso"*) forage when it is mature, but is also consumed eagerly when green; spontaneous *lupinella* (*Onobrychis* sp.) is also favoured by cattle when it is dry; all annual and perennial medicks (*Medicago* sp.) are consumed mature with gusto; poppies (*Papaver* sp.) are hungrily sought out by cattle when they are green; and, finally, wild oats are also favoured by foraging cattle. "They eat all that is in the woods" (*"Tutto che c'è nel bosco si mangiano"*) (Tolve, 70 year old *mandriano* -- herdsman of cattle).

The same applies to sheep and goats which exhibit a preference for mature growth, particularly wild vetches which the beasts seek out, picking out fallen seed pods. Such wild legumes (clovers and medicks too) are sweet and much sought out by flocks (*"Scelgano la veccia, i trifogli matura -- la cercano"*) (Tolve, 45 year old *pastore*). Sheep and goats consume more of the burred medick pods when they are dry (mature) in the same way that they chose dry clover with mature seeds (Irsina, *c.* 55 and 60 year old mixed farmers). Sheep and goats are also reported to favour spontaneous ('weed') growth over "domesticated" sown crops. With reference to the damage done to cereals by sheep and goats entering maturing fields, a *pastore* noted that sheep and goats enter these fields not to consume the cereals, but in search of the spontaneous growth, to graze selectively 'weeds' in amongst the maturing sown cereals (*"Erba selvatica é la piú tenera e dolce tra i seminativi -- le pecore spezzano il grano quando vanno a cercare queste erbette negli campi di grano"*) (Oppido Lucano, 60 year old mixed farmer). This is true also of sheep and goats grazing in fields of *favini* in which they avoid the bitter growth of the small fava beans, and selectively consume the spontaneous grasses and vetches that emerge in amongst the crop plants (Oppido Lucano, 64 year old mixed farmer). This preference is exploited by *pastori* and farmers who use flocks to graze back cereals in the early stages of their growth, and at the same time, to consume the spontaneous growth in the sown arable. "Sheep (and goats) are used to 'clean' arable lands, through their grazing the plants do not come to seed" (*"Le pecore fanno pulita la terra se stanno sempre la -- l'erba non porta frutto"*) (Oppido Lucano, 86 year old farmer).

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[11] *"Le vacche scelgano erba selvatica -- il foraggio selvatico"* (Tolve, 70 year old cattle herder).

In describing excellent spontaneous forage, informants made particular reference to such spontaneous plants as yellow vetchling (*Lathyrus aphaca*), snail medick (*Medicago scutellata*), mustard (*Sinapis* sp., dialect term is *"lassane"*), corn poppy (*Papaver rhoeas*), and wild oats. An informant in the Tolve area described a recent hay crop with such an abundance of snail medick that while haying, its seed disseminated extensively. "There were so many seed pods, that the sheep were eating these in the stubble until the end of August" (*"C'erano tanti che le pecore li hanno mangiati tutt' agosto"*) (Tolve, 47 year old *pastore*).

Those with animals used hay crops to reduce wild oats and other spontaneous plants ('weeds') in the following crops, because cutting the hay green removes immature plants which have not yet dispersed their seeds (Oppido Lucano, 65 year old mixed farmer).[12] In order to reduce wild oats in sown cereals, the most effective technique involves sowing and cutting hay for at least three consecutive years. In regard to wild oats, universal was the insistence on the ability of this plant to persist because of its fire - resistant glumes (protecting the seeds), and the delayed germination of each of the three seeds within the spikelets -- one germinating each year.

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[12] Most 'weeds' are annuals, maturing in late spring through to early summer, an adaptation to a semi-arid environment (Hall et al. 1979:151). These plants survive the summer in the form of seeds. The faecal pellet contents reveal that the seeds of spontaneous legumes, grasses and forbs are consumed selectively by ovicaprids from June through August.

From the burned stubbles, spontaneous growth emerged which included wild sulla, vetches, and also wild peas (*Lathyrus* sp.) cut in 1994 as hay for cattle (Oppido Lucano, 65 year old mixed farmer). Observations of fallow fields showed a broad variety of legumes, grasses and forbs, many of high forage value.[13] These are spontaneous plants which are, on the whole, typical of arable lands. However, in assessing the composition of the spontaneous flora, informants emphasized the shift in composition away from vetches, clovers and medicks, and to these other plants which have greater success in deep-ploughed fields.

Complaints about the loss of spontaneous legumes in the arable were matched by complaints regarding the decreased numbers of livestock grazing in untilled lands. In the words of one informant,

> "Spontaneous vegetation is not consumed any longer. There are no longer animals grazing *allo stato brado* [in the "wild" state, that is, grazing on open pastures] and for this reason chain fires occur -- the grasses increase every year" (*"L'erbette selvatiche non si consumano più. Mancano gli animali allo stato brado e allora succedano gli incendi a catena -- l'erba aumenta ogni anno"*) (Oppido Lucano, 65 year old mixed farmer).

Spontaneous vegetation in untilled areas is rich with valuable forage. In the environs of Minervino Murge on grazed pastures (untilled) were observed an abundance and variety of high value forage legumes among the flora.[14] Present also was abundant wild asparagus, Spanish broom, bramble bushes and *Genista* sp., all of which attest to prescribed burning -- the evidence of which was visible in the spot burnt bramble bushes (see Plate 25 for Tolve area example).

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[13] *Alopecurus* spp., *Phalaris* sp., *Agrostis* sp., *Avena* spp., *Bromus* spp., and *Lolium*spp., were all indicated to have high forage value, particularly *Phalaris* spp. and *Lolium* spp.. Among the spontaneous forbs in the arable also of high forage value, is the introduced *Amaranthus retroflexus*. *Silene alba*, *Chenopodium* sp., and *Atriplex* sp., *Euphorbia heliopsis* and *E. peplus*, *Polygonum* spp., *Rumex* spp., *Urtica* spp., *Sinapis* spp., *Capsella bursa-pastoris*, *Myagrum perfoliatum*, *Papaver rhoeas*, *Fumaria officinalis*, *Ranunculus* sp., *Myosotis* sp., *Cirsium* sp., *Convolvulus* sp., *Sonchus* sp., among others.

[14] *Scorpiurius muricatus; Medicago polymorpha; Medicago sativa var. falcata; Medicago tornata; Vicia sativa; Lathyrus spp.; Trifolium stellatum; Trifolium repens; Astralagus sp; Hedysarum spp., Avena sterilis/fatua.*

The brush pasture of the Irsina area was full of the same legumes, and others.[15] Also present in abundance were flora typical of *macchia* vegetation such as lentisk and Spanish broom. *Pastori* grazing their animals along the Bradano and the surrounding hills judge this flora to be a "luxurious" pasture.

> "The pasture is deluxe, there is abundant *sulla*, willow, *Scorpiurus* sp., wild cane, Spanish broom and lentisk" (*"Il pascolo è di lusso la, c'è molta sulla, salice, lingua pecorina, canna selvatica, ginestra, lentisco"*) (Irsina, *c.* 50 year old *pastore*).

A parallel flora is present in the Tolve area, and wild *sulla* is there identified as a deluxe forage plant which grows abundantly and spontaneously in the open woods. The flocks graze it both in the spring and then return to graze it again when it is mature with seed in June and July at higher elevations (Tolve, 75 year old mixed farmer). During the summer when there is abundant forage, *sulla* is left largely untouched until it carries mature seeds at which point it is again grazed. This same pattern holds for wild annual medicks and vetches. The consensus among informants is that clovers, medicks, and vetches particularly attract livestock once the seeds are mature. "They [sheep and goats] eat it ["wild clover"] in spring and then leave it during summer until they eat it again when it produces seed" (*"La mangiano [la primavera] e la lasciano durante l'estate, e poi la mangiano quando fa il seme"*) (Tolve, 56 year old mixed farmer).

Traditionally, as one Tolve *pastore* observed, everyone grazed their animals year round *"allo stato brado"*, there was extremely limited use of stall feeding or cultivation of hay. Not even wheat straw was used as supplementary feed in-stall. The use of the *foraggine* (sown pasture) and sown hay has increased dramatically in recent years.

Top seeding

Two forms of top seeding (the sowing of seeds into standing crops and pastures) were described in Basilicatan traditional farming. The first, and most prevalent, is the top seeding of bare fallow, of sown pasture (the *foraggine*) and farmyard pasture (the *pandone*). The *foraggine* and *pandone* are described separately (below). The second form of top seeding consists of sowing of domestic forage legumes into standing cereal crops. Informants universally acknowledged the practise, but many argued that the soils they worked were rich in spontaneous wild grasses and legumes such as vetches, clovers, and medicks, rendering the practise unnecessary (e.g. Calvello). However, top seeding seems to have been a standard practise across communities, its effects parallelling those of manuring fields which produced abundant spontaneous growth emergent from the dung.

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[15] *Astralagus* sp., *Hedysarum spinosissimum, Coronilla scorpiodes, Vicia sativa, Lathyrus aphaca, L. hirsuta, Vicia cracca, Medicago polymorpha, M. tornata, M. aculeata, M. orbicularis, M. sativa* var. *falcata, Melilotus alba, M. officinalis, Tetragonolobus purpureus (Lotus tetragonolobus), Trifolium repens, Trifolium* spp. Along the Bradano was also observed *Lotus siliquosus.*

Top seeding fallow lands as pasture is common in the mountainous San Cataldo area, but was reported also by informants in more arid Murge of Apulia, where *pastori* also make use of top seeding clover into wheat/oat/barley stubbles for pasture which later will be cut for hay. Where soils are especially weak, a mixture of seeds of all types but commonly including broad beans, barley, vetch, vetchling, and lupines is broadcast on the September to April uncultivated fallow (e.g. San Cataldo, 78 year old mixed farmer). These broadcast seeds serve two purposes. First, the growing plants are a rich pasture throughout the winter until April/May. Secondly, they serve as green manure, hoed under in preparation for sowing corn, beans and potatoes in the final period of the fallow rotation.

T. squarrosa forms part of the a hay maslin crop (*miscuglio per fieno*) in the Tolve area. In describing the practise of top seeding, an informant specified that clover is sown directly into cereal stubbles which have been first lightly disced. The same informant asserted that clover broadcast into disced stubbles is preferable to broadcasting onto unprepared stubbles. Using a neighbour's experience to illustrate the difference, he explained that the neighbour had sown clover directly onto unprepared stubbles which left the seeds vulnerable to drought after initial germination -- the germinated seed desiccated and most of the clover did not survive (Tolve 45 year old *pastore*).

Similarly, in the Abriola area, clover is also broadcast sown into wheat stubbles, grazed until April-May (depending on the season's production) and then protected and cut for hay June. These hay stubbles are sometimes burned -- especially if there were many spontaneous ('weed') plants during this 'bare' fallow. The burn is undertaken before ploughing and sowing to wheat. Informants affirmed the emergence of volunteer clovers post-burn in the wheat crop (Abriola, group interview).

Following upon wheat, top seeding bare fallow with clover (*Trifolium pratense*) is also a common practise undertaken in the San Cataldo area -- especially amongst those with little pasture and numerous animals. Clover seed is broadcast onto wheat stubbles to bolster the spontaneous legume content and increase its value as pasture and hay. The spontaneous hay and broadcast sown clover fallow field is grazed until mid-April or the end of March depending upon growth (precipitation) and hay requirements. In June it is cut for hay and the stubbles are burned. Clover in the soil seed bank[16] germinates following the burn and this is grazed until September when the fallow is ploughed and re-sown to wheat.

In describing top seeding, one San Cataldo *pastore* interviewed showed me where he had broadcast *Trifolium pratense* onto wheat stubbles dedicated as a bare fallow (Plate 28). The spontaneous growth is grazed until mid-April or, at the latest, until the end of March depending upon growth (abundance of precipitation) and hay needs. If the growth is abundant and the *pastore* deems it probable that a second cut of hay be achieved, then the field is protected from grazing mid-April. In June, the clover, volunteer wheat, and other spontaneous plants are cut for hay and the stubbles are burned. Following the burn, soil seed reserves (clover and other legumes, forbs and grasses) germinate and the rich pasture is grazed until September when the dry residues are ploughed under and the field is sown to wheat. In sum, the 'bare fallow' involves the burning of stubbles, incorporation of manure, followed by a later hay harvest of spontaneous growth that has emerged both from soil seed reserves and from the manure. A parallel may be drawn between top seeding and manuring: both fertilize and disseminate favoured (selectively grazed) flora (in the form of seeds that have passed through the animals).

These examples illuminate the problems involved in classifying fallows. Had a field not been top seeded with additional clover, the field would be considered to be under a 'bare fallow' although the spontaneous growth equally serves as pasture and might serve later also as hay. Decisions about the use to which the fallow 'crop' is put is made on the basis of "l'andamento della staggione" -- the month-by-month, week-by-week gauging of levels of plant growth, season, temperature and precipitation in the context of anticipated returns and production requirements. On the basis of the added clover seed, the above fallow is categorized by informants as either a 'bare' or a hay fallow. It is essential to later arguments to emphasize here that there is little to distinguish a 'bare' fallow from this top seeded hay fallow, that spontaneous growth including legumes characterizes both, both are grazed, both might be cut for hay. They differ in that one is richer in clover than the other (hence greater soil nitrogen is added).

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[16] Many seeds do not germinate one year, but will germinate in subsequent years. The delayed germination is the result of variably thicker seed coats, especially of forage legumes. At any time, the soil contains seeds which have yet to germinate. This is referred to as the soil seed bank or soil seed reserves.

In the Oppido Lucano, Cancellara and Vaglio areas, sainfoin (*lupinella*) was reported to have been top seeded into oats and wheat. With reference to the wheat crop, the initial sowing of *lupinella* was undertaken in February or March, sown directly into the growing wheat which was due to be harvested in June. Sheep (and goats) were sent in to graze the wheat until 15 March when it is on the cusp of developing a grain head. The *lupinella* which had remained small in among the wheat, was let grow following the wheat harvest. The following May a hay crop was taken off and the stubbles were grazed until the end of February, left and cut for hay again in May until the end of the third year whereupon the heavily grazed stubbles were either ploughed under as a partial green manure, or the *lupinella* is kept for pasture and hay from one or two more consecutive years before wheat sown again (Oppido Lucano, 85 year old mixed farmer; Vaglio, 73 year old mixed farmer). Top seeded *lupinella* in the environs of Vaglio is cut for hay once a year, and the seed renewed every third year or so (Vaglio, 73 year old mixed farmer). This hay was used mostly for feeding horses and mules, rather than sheep/goats, but was grazed by sheep and goats until the end of March after which it was allowed to grow for haying.

Another informant in Cancellara described top seeding *lupinella* in March into fields pre-sown to oats (the previous October) using a toothed harrow. In June this mixture was cut for hay. Then for 2-3 years after, the field would be kept in *lupinella* and yearly cut for hay (Cancellara, 82 year old mixed farmer). This type of long-term leguminous fallow crop for pasture and hay tended to be protected from grazing until at least one good hay crop was removed. However, this practise varies depending upon the season's precipitation, the availability of other fodder, the potential to get a better hay crop later in the season, and so on. In other words, this crop (and the majority of others) is a flexible resource, its use adjusted according to need and to the success of the crop and other fodder resources in light of climatological variability. Whether restricted to hay, and not grazed during growth, this crop and all other hay crop stubbles are always thoroughly grazed.

Another example of this practise, also from the Oppido Lucano area, involves top seeding berseem clover (*Trifolium alexandrinum*) directly into a growing oat crop sown in September-October once the oats are *c.* 25 cm high (usually March). The oats are harvested in June, and then the clover becomes a pasture for sheep and goats. It can also be cut once before it is turned into pasture. Stubbles are not burned, but are turned under as a partial green manure. Spontaneous regeneration the next year from seed occurs, but plant density is lower than where stubbles have been burned. Berseem clover is also reported to have been sown into wheat fields in spring. It develops after the first autumn rains in September - October. A fallow crop, it is first cut the following spring and can be cut for hay up to four times in a good year. Because it is an annual, once the seed is "finished", flocks are taken in to graze before the minimal stubbles are ploughed under as a partial green manure (Oppido Lucano, 81 year old agricultural worker).

Finally, in Cancellara, alfalfa is described as being sown into growing wheat as follows:

> Alfalfa is sown when the wheat is approximately 30 cm high, generally by March. The alfalfa would not have yet formed a seed pod by the time the wheat is harvested in late June-July with a combine. Then the alfalfa and wheat straw that remains in field is cut by the combine, then gathered and baled for hay. The alfalfa plants are strengthened by the cut, they tiller and grow more robustly, and with just a "finger of water" in these mountainous areas grow rapidly. In the hotter and drier Oppido area, this practise is not possible (Cancellara, 63 year old mixed farmer).

All of these examples involve the top seeding of legumes into stubbles of cereals, as part of a fallow rotation.. The latter form serves to fertilize growing cereals in addition to soils during the fallow. All are geared to producing an legume-enriched spontaneous hay crop from the fallow.

Sown Hay Fallow

The standing sown hay crop is also a variable element of a rotation, being left in for one or more years depending upon the availability of land, and what might be dedicated to sown hay. A standing sown hay crop such as clover, *lupinella*, *sulla*, medick or vetch, or some combination of these and a cereal (barley or oats) is a fallow crop more extensively cultivated today than in the past. Hay stubbles are not burned, but are rapidly ploughed under to capture the nutrients (a partial *sovescia*) and to allow the hot June sun bake the soil.

In the past, hay was cultivated in much lesser quantities in part because the tools at the disposition of the farmer rendered difficult harvesting large fields at the crucial period of growth. That is, crop size was restricted to the amount which could be harvested rapidly, before the hay lost its value and the seeds reached maturity -- the consequent seed loss reduces hay quality (see also Forbes 1982:265-266 for Greek farmers' use of the vertical gradient to combat this problem in their cultivation of vetch for hay). Hay must be harvested before seeds mature, while the plant is still green.[17] Even among the propertied, perennial pasture and hay crops were cultivated only on a limited scale. Setting aside arable land for hay for three to five years was undertaken, but only amounts necessary to feed plough oxen and horses were sown. For example, one land-poor informant commented that he used little *lupinella*, and only when they had a cow (San Cataldo, 70 year old mixed farmer).

The cultivation of hay as a specific field crop was and is undertaken only by those with livestock (beyond a mule and a couple of sheep and goats) and with sufficient land. Many informants asserted that these hay crops were sown especially as fodder for working animals such as oxen, and for milk cattle. For the land-poor, dedicating even a small field for three consecutive years to a forage or hay crop, was a luxury which poor households could not afford. Consequently, a high proportion of informants did and do not sow perennial legume hay crops, nor do they cultivate clovers, maslin hay crops, etc. These informants were those to use a 'legume-based garden-type fallow', and tended to have less fertile land worked on a two-year rotation (one year wheat, the next, fallow). Perennial legumes for hay (*lupinella*, *sulla*, alfalfa) were cultivated on a much reduced scale, and of the three, *lupinella* was the favoured crop. These crops are also higher risk in that they are more drought-prone than hardy vetch which is a favoured component for hay and forage throughout Basilicata.

In the past, the more abundant untilled, spontaneous pasture available also precluded having to accumulate large quantities of hay. "Untilled lands do not exist any more. Before ("*prima*") one went to cut wild plants in the untilled lands ("*saldoni*") -- now almost all is tilled land" (*"I terreni saldi (saldoni -- incolti) non ci sono più. Prima si andava a tagliare per fieno le piante selvatiche nei saldoni -- ora quasi tutto è coltivato"*) (Cancellara, 69 year old farmer). The loss of pasture to arable has been significant, particularly in the valleys along the river where oak forests dominated, providing grazing resources for local Podolian-breed cattle and pig herds. (*"Nello basso Bradano, c'erano parecchi terreni incolti proprio perchè c'erano queste mucche"*) (Oppido Lucano, 70 year old mixed farmer). The loss of untilled pasture has encouraged the accumulation of hay even in areas where traditionally hay was not essential for flocks -- the warmer valleys. Furthermore, the subsidies provided per head sheep through the Common Market agricultural policies, have made it economically feasible and worthwhile to supplement sheep and goat diets with sown pasture and hay for those with sufficient land.

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[17] A recognized method for reducing "weeds" in the following wheat crop, those cutting hay for their own beasts on their own land tend to cut it greener (more effective weed control) than those who cut hay to sell it (when it is more mature, it is more plentiful and heavier, but the "weed" seeds have largely dispersed at this point).

Because snow does not accumulate at the lower elevations such as the Bradano plain (250 m a.s.l.), stall-feeding was nearly unknown in the past. An elderly *pastore* of Oppido Lucano described working for a landowner on one of the large *masserie* in the Bradano valley, grazing 350 sheep and 50 goats on untilled pasture, fallow, in woods and brush pasture ("*spineti*"). Not only were these a larger component of the landscape than today, but, he added, under the *padrone*, sown hay was not used. The sheep made do with uncultivated pasture and a mixed straw of wheat and oats.

Important here are also naturalized perennial legumes which are cut for hay whenever encountered, these form part of the spontaneous vegetation described above. The distribution of both sown and spontaneous legumes is influenced by temperature, precipitation and soils. As one informant explained, ". . . each zone is suited to growing certain types of plants, and not all areas are suited to grazing -- sweet soils where there is wild *sulla* are good for grazing" (*"Non sono tutti luogi buoni per pascolare -- i terreni dolci sono buoni -- dove c'è la sulla selvatica. . . . Ogni zona era adatta a certe specie di piante"*) (Cancellara, 69 year old farmer).

In the environs of Minervino Murge, perennial legumes for hay are not commonly cultivated with the exception of limited amounts of alfalfa, although this crop is more typically sown in the cooler and wetter zones, that is, at higher elevations. Other informants in the environs of Irsina denied any use of sown clover, sainfoin (*Onobrychis viciifolia*), alfalfa (*Medicago sativa*), and Italian sainfoin (*Hedysarum coronarium*). They explained that this is a drought area not suited to growing perennial medick and sainfoin hay. The greater aridity of both areas results in significant crop failure. The same informants reported that their father also always put in *c.* 1 ha of maslin hay, a mixture of vetch and oats. Vetch is suited to this drought - tending zone and is a recognized excellent producer of nitrogen for the soils. Conversely, in the mountain areas, sown hay was traditionally, and remains an important crop for maintaining flocks over the colder winter and particularly during periods of snow accumulation (Irsina, 55 and 60 year old mixed farmers).

Italian sainfoin (French Honeysuckle/Spanish sulla, ***Hedysarum coronarium***) - ***Sulla***

> "For sheep, *sulla* is the best grass" (*"La sudd' per le pecore è la migliore erba"*) (Oppido Lucano, 83 year old *pastore*).
>
> "*Sulla* is a stupendous grass for feeding livestock" (*"La sulla è una erba stupenda come allimentazione del bestiame"*" (Oppido Lucano, 71 year old mixed farmer).

Sulla (Hedysarum coronarium) is considered excellent forage for sheep. Ideally sown in May, this legume persists in stubbles for at least ten years. It can be cut for hay continuously, and will produce almost three cuts of hay annually (*"Resiste nella stoppia almeno 10 anni, tagli sempre -- vale quasi tre tagli, come l'erba medica"*) (Oppido Lucano, 60 year old *pastore*). *Sulla* grows spontaneously in clay and sandy ("sweet") soils, and mid-range temperatures --" neither too hot nor too cold" (Cancellara, 69 year old farmer), and is grazed year-round by sheep and goats. It is also sown to anchor soils along railroad scarps, where the plants are grazed, cut for hay, and maintained by burning. In the Bradano plain and Irsina areas, several informants commented that the zone is too arid for cultivating *sulla* and thus it was not much cultivated in the past nor today because it gives a low return.

Characterized as a tall-growing plant sown for hay (Cancellara, 82 year old mixed farmer), in many fields and pastures *sulla* has become part of the spontaneous vegetation (it has become "naturalized", as has sainfoin). Commonly considered a spontaneous (i.e., wild) plant, naturalized *sulla* is a favoured and valuable forage plant (e.g. Oppido Lucano, 85 year old mixed farmer). Informants view these plants as 'wild' legumes because of their persistence, spontaneous regrowth and seeding -- *sulla* thrives without fertilizer or special attention of any sort, and it disseminates itself. The plants ripen during May and June. By October new growth has already emerged which is consumed until May - June (Oppido Lucano, 60 year old *pastore*).

> *Sulla* emerges on its own in untilled lands, it is spontaneous vegetation . . . sheep go there first [to graze *sulla*] . . . it is favoured. (*"La sulla nasce da sola nei terreni incolti, è vegetazione spontanea . . . le pecore vanno prima la . . . è gradita"*) (Oppido-Tolve, 73 year old mixed farmer).

Also reported to be sown into untilled pastures to improve the pasture quality (Cancellara, 71 year old mixed farmer), like *lupinella, sulla* is typically sown on its own for hay in rotations, about September to October at the first rains. Fields are typically left for three years running (like *lupinella*), and grazed during winter until the end of March. By May, it is ready to cut for hay. *Pastori* commented that preferred grazing of *sulla* occurs when the plant is flowering and later, in seed, although it can be grazed throughout the year (e.g. Tolve, 68 year old *pastore*). Grazing is said to enhance tillering (*"accestimento"*), described as rapid and enhanced regrowth.

In the San Cataldo area, *sulla* (*"la suoilla"*) was little used because the soils are not appropriate. Used as pasture in lowland areas and then protected from grazing to make hay. In the environs of Oppido Lucano, *sulla* was cultivated a great deal in the past, as was *lupinella*. *Lupinella*, however, was not favoured because when dry, its leaves would fall and the woody stem that remained is not favoured by the animals (Oppido Lucano, 74 year old farmer) .

A Cancellara informant reported *sulla* to be a longstanding crop within his wheat field, emergent after the wheat stubbles had burned. The emergent growth of *sulla* is cut for hay (type of fallow), its stubbles are not burned, but are ploughed under and sown again to wheat (Cancellara, 73 year old mixed farmer). I viewed a similar field in the environs of Oppido Lucano, where the under-crop of *sulla* became the field hay pasture and hay crop after the wheat had been harvested. This field of approximately 2 ha had been a permanent pasture of *sulla* for 15 years. A highly nutritious, appetible, luxurious pasture, it can be grazed year-round and was cut once a year for hay. The "stubble" of the *sulla* was never burned. Although the plants can be grazed year-round, the amount of remaining seed was monitored to insure that sufficient seed remain for the following year's fallow. Each year, some seed was collected and then broadcast before ploughing the stubbles under, to supplement the seed set by the standing crop. This particular field was of great interest because *sulla* had been not been sown for five years. In fact, the field had been sown four consecutive years to hard wheat, each year the stubbles had been burned. The fifth year, the field was put to a 'bare' fallow, and the spontaneous growth of tall grasses such as wild oats had been cut and were lying in the field. There was reportedly no evidence at cutting of the presence of *sulla*. However, upon closer inspection, the field was dense with this legume calculated a minimum of 10 plants per m^2, blooming and with seed which must have emerged from seed stored in the soil from at least four years previously, that, post haying, emerged as the dominant plant. The seed was characterized by the informant as resistant to burning (*"Il seme è resistente, non si brucia facilmente"*) (Oppido Lucano 65 year old mixed farmer).

Sainfoin (*Onobrychis viciifolia*) - *Lupinella*

The perennial legume known locally as *lupinella*, is among the most widely sown for hay. It is used in maslin hay crops (with alfalfa), top seeded into cereals, both for hay and for grazing, and even broadcast sown in untilled (*"saldoni"*) areas to improve pastures (Cancellara, 71 year old mixed farmer). *Lupinella* does not grow well in all soils or in too arid areas as Cancellaran informants were quick to point out. Rather, they specified that *lupinella* grows well in sandy, depleted, white (calcareous) soils, where vineyards and olive groves are generally situated (e.g. Cancellara, 69 year old farmer). For example, one informant cultivated *lupinella* in "light", less fertile soils. A piece of land was set aside for 3-4 years for this perennial forage plant which was cut for hay and then grazed until March or latest, April. The mixed farmer described the crop as "good stuff for hay and as pasture" (*"robba buona per pascolo e fieno"*) (Cancellara, 78 year old mixed farmer). The selection of forage legumes for cultivation varies from farm to farm. Consequently, a farm at 600 m a.s.l., but south and east facing is too dry for cultivating either *lupinella* or *sulla*. Nevertheless, as the farmer observed, "in the past, a lot of *lupinella* was cultivated in the surrounding [cooler, wetter] zones nearby" (*"Prima si usava molta lupinella in altre zone qui vicino"*) (Oppido Lucano, *c.* 65 year old mixed-farmer).

Lupinella sown 30 years ago grows now as part of the spontaneous vegetation in uncultivated areas, like *sulla*, it has become naturalized (Plate 38), and has been observed to emerge in fields that are not deep-ploughed from seed remaining in the soil from a previous crop. Among the sown crops, this forage legume is second only to common vetch for its resistence to drought and success in poor soils.

Fields of *lupinella* are always grazed except between March through May during which it is protected to grow for hay. In wet years it is possible to get 3 cuts of hay off a field -- one informant keeping a field of *c.* 0.8 ha for 10-12 years. In Cancellara, a mixed farmer observed that in his father's day (1920s) they used a type of hand press to "squeeze" the hay after gathering. The *lupinella* was put in for 5-6 years, grazed until March and then one cut was taken of hay, and then grazed from June on (until the following March) (Oppido Lucano, 74 year old mixed farmer).

In another example from Oppido Lucano, throughout the winter until March sheep and goats are grazed on *lupinella*. In March-April, flowers and then seeds are allowed to develop before it is cut for hay. Following a little rain, it grows again to be grazed. After three years the hay stubble is interred as a green manure. The following wheat crop is clean because the three years of haying eliminates annuals disseminating mature seed (*"distrugge tutte le erbe"*) (Oppido Lucano, 80 year old agricultural labourer).

Lupinella has been largely replaced by alfalfa according to some informants. In the past, *lupinella* was the chosen forage legume (along with common vetch) sown in the weakest soils which were found *"in montagna"* (in the mountains) close to the town, but not in the valley with the exception of wetter fields along the Bradano river. Described above, it was also top seeded into growing wheat and oats (Oppido Lucano, 85 year old mixed farmer). Typically it was cultivated to feed mules and horses which required high energy feed for ploughing, and many farmers and mixed farmers stopped cultivating *lupinella* when tractors replaced horses and mules. *Lupinella* fields were maintained for three years, cut only once a year for hay in the month of May (Bradano valley), but in wetter areas during years of abundant precipitation, it could be cut for hay 5 or 6 times over the year (*"Pianta con fiori rosa ... pure dura tre anni . . . Si semina da se. Si può tagliare 5 o 6 volte per fieno durante anni buoni"*) (Oppido Lucano, 70 year old mixed farmer).

In Oppido Lucano *lupinella* is a favoured forage legume for restoring weak (thin) soils. It is sown to fertilize weak soils weak in a lengthy fallow which lasts at least three years without additional sowing (Oppido Lucano, 81 year old agricultural worker). Even if the soils are weak, a good harvest of hay or seed is usual. *Lupinella* pods are broadcast sown (the plant spreads, so informants maintained that it is of no consequence that seed is sown sparsely and in the pod -- the seeds are difficult to remove from their pods) in February or March (Oppido Lucano, 81 year old agricultural labourer). Hay production is reportedly low the first year and then increases over the next year, but begins to weaken in the third year. Consequently, in the fourth year, the seeds were left to ripen (no hay was harvested) to self-seed and regrow if the farmer chose to keep the land under *lupinella*.

The abundance of forest pasture may be a factor in the general absence of sown hay in the Tolve area, where few *pastori* sow perennial legume pastures or hay crops, and then only *lupinella*, sown as part of a hay maslin crop or for pasture (e.g. Tolve, 42 year old *pastore*). *Lupinella* is reportedly preferred by livestock when it is still green. Once it begins to mature, the plant tends to become woody, particularly at the seed stage, and the animals pass it over (Tolve, 75 year old mixed farmer). Tolve *pastori* without exception emphasized the forage and hay value of the annual medicks and vetches that emerge spontaneously in the fallow and in the untilled grazing lands, particularly following a burn. Considered excellent forage, and where they emerge as near-monolithic growth, they are cut for hay in May (*"Il luogo pulito si puo anche falciare"*) (Tolve 42 year old *pastore*). The use of spontaneous hay and pasture dominated in this area, as it continues to dominate today.

Lupinella has always been used for hay in Calvello and is grazed by sheep until the end of April after which it is protected from grazing to be cut for hay. *Lupinella* traditionally is also a popular forage and hay plant in the Abriola area where it is perceived to be a forage legume that grows well in dry soils. Similarly, in the environs of San Cataldo, *lupinella*, spontaneous hay and alfalfa are the most popular forage and hay crops. *Lupinella* is cut for hay in the San Cataldo area up to three times over the year and can be grazed year-round, as it does not have the toxic properties of alfalfa which induces bloat in animals during its early growth stages.

The perennial crop alfalfa (*Medicago sativa*), is frequently sown together with *lupinella* in the San Cataldo area. Depending upon the amount of precipitation during the growing season, one, two, or even three (rarely) cuts of hay may be taken after which the stubbles serve as pasture. Typical more of cooler and wetter zones, this crop is sown in with medicks because of its erect growth, supporting the more prostrate medick and simultaneously providing insurance against total crop failure as *lupinella* is more drought resistant (San Cataldo, 69 year old mixed farmer).

Informants reported in Cancellara similar practises to those found at San Cataldo di Bella. *Lupinella*, like alfalfa (*"erba medica"*, *Medicago sativa*) is protected from grazing for 3 years to be cut for hay. In three good years the field might produce six cuts of hay. Sown in October, and first cut in June, if the growing season was good, a second cut might be possible towards the end of July (depending on water). However, in order to produce abundantly, like alfalfa, *lupinella* has to be protected from grazing (Cancellara, 84 year old mixed farmer).

Alfalfa (Lucerne, *Medicago sativa, Erba medica*)

Cultivating alfalfa involves preparing the seed bed, sowing, and then harrowing. Like all the other legumes, these plants are sown in fallow, to enrich the soils, or as most informants phrased it, "to fatten the land again" ("*per ingrassare i terreni di nuovo*"). Because this legume cannot be grazed except under highly controlled grazing (bloat problem), those who cultivated this legume kept only small fields, but for extended periods. The wetter the year, the better is production, an informant noted of this legume, and further, that the more one cut it for hay, the better it grew ("*Più tagli, più sviluppa*") (Avigliano-Cancellara 78 and 44 year old mother and daughter, farming household). This is a crop most popular in the mountainous zones, at higher elevations where it produces most abundantly.

In the Cancellara area, several informants emphasized that seed clover and medick was not sold until recently in this area. Alfalfa and clover seeds are reported by a number of informants not to have been available for sale in the past. According to one Cancellara informant, alfalfa began to be used for hay as late as 1968-69 (Avigliano-Cancellara 78 and 44 year old mother and daughter, farming household). In the Calvello area, informants indicated that little alfalfa is cultivated, much more use is made of spontaneous hay in this heavily wooded area with plentiful common grazing. Similarly, an Abriola informant asserted that alfalfa is a crop mostly cultivated to supply cattle fodder, adding that traditionally, sheep and goats had to make do with spontaneous plants, and were not provided supplementary feed or fodder (Abriola, 63 year old mixed farmer).

A number of irrigated fields of alfalfa were observed in the Bella-Ruoti-San Cataldo area. However, for the most part (and traditionally) this crop is not irrigated. Unirrigated fields yield a maximum of three cuts for hay per year, although informants qualified that in cooler zones (next to the river), one might get an exceptional four cuts of alfalfa over the course of a year. Most years yield two cuts of hay. In the San Cataldo area, small fields of alfalfa are left for 8-10 years, serving as pasture after two cuts for hay have been removed. The first cut is undertaken in February - April. After the last cut in October - November, when frost arrives, sheep, goats, and cattle use these fields as pasture. Sheep and goats were observed throughout the area grazing on alfalfa stubbles once the hay had been cut and collected (Plate 12). Alfalfa begins to grow in April from which time, until it is cut (*c.* 20 May) it is not grazed (San Cataldo, 69 year old mixed farmer).

Alfalfa stubbles are not burned, a suggestion met with horror by one informant who declared that this would make it "lose its potency as a fertilizer" (San Cataldo 83 year old mixed farmer). Rather, stubbles are ploughed under using a disc harrow, incorporating the stubbles into the upper soil layers -- a form of green manuring. The same practise is undertaken for the sown hay maslin of alfalfa and *lupinella* (described above) which is maintained for 5-6 years in a row, then disced under followed by ploughing. This crop is then succeeded by cereals for three years: first hard wheat, then oats, followed by barley (San Cataldo, 69 year old mixed farmer).

The lower elevations in the environs of Oppido Lucano are considered for the most part too dry to grow alfalfa, a crop which is associated with raising cattle (Oppido Lucano, 74 year old farmer, agricultural labourer). Nevertheless, a number of informants kept a field of alfalfa -- for example, one maintained a field for cattle fodder for ten consecutive years (Oppido Lucano, 71 year old mixed farmer, Bradano plain). Alfalfa is used more for hay than pasture, and is particularly good for cattle, but is not considered of great value for sheep because of its toxic properties causing fatal bloat to sheep grazing young plants.

That alfalfa was little used in the past because of the valley climate is true also of the Tolve area where only one informant reported cultivating alfalfa (Tolve, 75 year old mixed farmer). Those who did cultivate alfalfa in the Bradano valley did not irrigate the crop, but sowed it on relatively wet soils near the river. It was not used as a component of hay (maslin). At the end of March the hay would be harvested, but the stubble was not burned. What remained was disced under as a green manure. After three consecutive years of medick, wheat was put in (Oppido Lucano, 70 year old mixed farmer, Bradano plain).

Sown Hay -- Annual Legumes

Today, most annual legumes are sown with either barley or oats as a maslin hay crop. In the past, maslins of cereals and legumes also were sown. For example, a fallow of sown maslin pasture/hay crop composed of oats, peas and barley, or of clover and vetch, were common. Sown in October, grazed only during February and March, maslins were cut at least once for hay in May (Oppido Lucano, 85 year old mixed farmer). Because seed was difficult to procure (and expensive), most producers sowed annual legumes separately as well, in order to procure seed for a next crop.

Vetch (*Vicia sativa*)

> In antiquity vetch was cultivated here. Now are sown maslins of vetch, clover, fava beans, oats and it is cut green for hay. Stubbles are not burned, but the animals consume all the stubble. ("*Nei tempi antichi si usava la veccia qui. Ora si mettano i miscugli di veccia, trifoglio, fave, avena e si taglia verde per il fieno. La stoppia non viene bruciata – gli animali mangiano tutta la stoppia*") (San Cataldo, 83 year old mixed farmer).

Traditionally, vetch, and not sown clovers were cultivated in the environs of San Cataldo, true also of the Cancellara and Abriola areas. In Cancellara, vetch is considered the best-adapted to local soils and climate (Cancellara, 73 year old mixed farmer). In Abriola, as elsewhere throughout Basilicata, vetch (*Vicia sativa*) is traditionally and presently the most commonly cultivated of the legume hay crops. It is grown in association with oats as a maslin crop for hay and also as *foraggine*.[18]

The favoured sown hay crop in the Vaglio area appears to have been common vetch (*Vicia sativa*). It has fallen out of favour because of its prostrate growth which impedes harvesting except by hand, and even so, much was left in the field – both in terms of seed loss and whole, fallen plants (Croce 1930:113-114). Most producers now mix vetch with oats or barley, and perhaps also clover or peas for hay. The oats/barley keeps the vetch from lodging, and permits the use of mechanized harvesting. In the Tolve area too, vetch is cultivated in a maslin crop with clover and barley. The crop serves as pasture and is grazed from February until the end of March at which time it is protected from grazing until a hay crop is removed (Tolve, 75 year old mixed farmer).

Vetch was also traditionally a favoured hay crop amongst the Cancellara mixed farmers, having, as was frequently expressed, the added benefit of being an excellent crop for "refreshing the soil." Traditionally heavily used ("*molto sfruttato*"), vetch is painful to harvest as the pods prick the hands (Oppido Lucano-Tolve, 73 year old mixed farmer). Like the small fava bean, the land-poor cultivated vetch to sell the seed, but kept the straw for fodder (e.g. Cancellara, *c.* 65 year old land-poor farmer; 62 year old land-poor farmer).

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[18] The difference between the two is only in the anticipated use of the crop: the *foraggine* is cultivated in a field generally close to the animal pens, it is enclosed and is used as grazing for sick, lactating and newborn sheep and goats) until the beginning of April today, and in the past.

Vetch was also cultivated for seed in the Oppido area, especially sown to this end in weak soils where it tends to remain small and produce lots of seeds. Furthermore, in depleted soils its growth is limited so that it does not lodge (which results in mouldered seed). Vetch is also sown for hay in the environs of Oppido, especially in maslins like those described above, and is harvested at the end of May. Given reported negative effects to the plants when grazed by adults, vetch is stated to have been grazed before haying only by lambs which were also allowed limited grazing in the cereals in order to fatten them up (Oppido Lucano, *c.* 65 year old mixed farmers).

Unlike alfalfa, *lupinella*, and *sulla*, vetch was traditionally and remains an important forage crop in all areas, regardless of elevation. Reported to have been cultivated in the Irsina and Minervino Murge areas, it continues to be sown, but in the maslins now popular throughout Basilicata. For instance, it is commonly sown with oats in the Irsina area for hay (*c.* 55 and 60 year old mixed farmers).

Fenugreek (*Trigonella foenum graecum, Trigonella*)

Fenugreek was a widespread hay crop in Basilicata until approximately six years ago (in the Oppido Lucano area). All informants acknowledged its past use, noting that it was resistant to heat, cold and drought (e.g. Vaglio, 73 year old mixed farmer). All reported its noxious odour, although many used this legume in the past, particularly for hay which, once dried, apparently lost some of its pungent odour (Tolve, 75 year old mixed farmer).

Evidently, this crop which produces a luxurious, nutritive and abundant growth is no longer used because of the smell which is imparted to the milk and meat of the livestock consuming it. Its past popularity is accounted for by its high nutritional value: livestock would grow fat and produce lots of albeit malodorous milk when fed this legume (Oppido Lucano, 74 year old farmer). Cattle apparently eat fenugreek with relish, although the smell is said to make the meat and milk repulsive. Heavily used in the area of Vaglio, fenugreek was not fed to livestock for 15 days before slaughtering in order to reduce the odour imparted to the flesh. The abandonment of this forage legume also speaks to changing tastes and the increased marketing of milk and meat in the formal economy (Oppido Lucano, 71 year old mixed farmer).

Clovers -- *Trifolium* sp.

Described above, clovers are popular forage legumes broadcast sown into growing cereals (top seeded). Not as widespread a crop as it is today, clover was sown in the past when all work was still undertaken by hand. It was harvested for hay and then the second growth was cut when mature and threshed using flails in August to procure seed. As is the case with all legume hay crops, stubbles are and were not burned, but were ploughed under as a partial green manure. Clover was traditionally cultivated in Basilicata, but in the absence of a seed distributor (a position filled by the agricultural consortia), it was a labourious process to procure seed each year because of the small seed size. As a result, the larger seeded *lupinella* and vetch were preferred (Oppido Lucano-Tolve, 71 year old mixed farmer; Cancellara, 84 year old mixed farmer).

In cultivating clover, a disc or harrow to prepare for seeding clover, is sown on the surface and the rain buries the seed (*"non si ara in profondità"*) (San Cataldo-Ruoti, 83 year old mixed farmer). Cut once a year at the beginning of June, the stubbles are not burned, but are grazed until September after which the remaining, closely grazed stubbles are disced under as green manure (ibid.).

Clover requires warmth and water for growth. Seed-rich manure is used to fertilize the fields sown to clover, its addition is reported not to affect negatively the clover crop because the sheep graze these and "clean" the clover of the spontaneously germinated "impurities" (Oppido Lucano, 64 year old mixed farmer, Bradano plain).

In the Bradano river/Irsina area, informants reported that they have always used *Trifolium squarrosum*. Clover is much more commonly sown today than was the case in the past (Irsina, *c.* 55 and 60 year old mixed farmers). In Abriola, *T. squarrosum* and *T.alexandrinum* (berseem) were grown as pasture and hay crops (Abriola, 63 year mixed farmer). However, several Cancellaran informants reported that seed clover as well as alfalfa is a relatively recent introduction and was not marketed 40 years ago. Clovers sown in this area in the past was a variety described as growing to the same height as the domesticated, sown varieties, and similar in appearance to *T. squarrosum* that produced excellent growth and forage in wet years (Cancellara, *c.* 60 year old mixed farmer).

In addition to the top seeding examples described above, in the environs of San Cataldo, berseem (*trifoglio greco*) is top seeded into wheat fields in spring and does not grow until September-October (after the harvest). With the first autumn rains, the clover develops to yield an abundant crop the following spring. Berseem can be cut for hay three to four times a year, like alfalfa (Oppido Lucano, 81 year old agricultural labourer). Rather than cutting for hay, after the first cut it is grazed because subsequent hay diminishes and it is more valuable as a standing crop. Following the sown wheat, the wheat stubbles are burned, and the clover reemerges. Each year it increases in amount and becomes the "owner of the soil" (*"fa il padrone della terra"*) (San Cataldo, 70 year old mixed farmer)

Clover stubbles were (and are) never burned. First, there is no need to burn because after the crop has been cut for hay in May (*c.* 330 m a.s.l.), little is left, particularly after flocks have grazed the stubbles to the ground. Second, whatever remains is quickly ploughed under as a partial green manure.[19] In the past, clover was sown separately and not as part of maslin, which is the form in which it is sown today (Oppido Lucano, 71 year old mixed farmer, Bradano plain).

Although this forage legume is traditionally perceived to be primarily a crop for cattle, other Oppido area informants sow clovers selecting from the available seed which may be purchased from the local vendors (*Trifolium incarnatum,* or *T. squarrosum, or T. alexandrinum*). Red clover (*Trifolium incarnatum*) is one of the most widespread clovers currently sown for hay, the seed sold at the agricultural consortia. "The first cut is undertaken, and then it grows again (*"Si fa il primo taglio e poi rinasce di nuovo"*) and is left for grazing. Berseem is also sown (in October) and cut for hay at the beginning of June (*c.* 580 m a.s.l.). It is then grazed heavily until all has been consumed -- typically by the beginning of July when all that remains of the dried plants has been grazed to the ground. This stubble is ploughed under in September (Oppido Lucano, *c.* 65 year old mixed farmer).

The same seed is available in Tolve, resulting in the cultivation of the same varieties (*Trifolium incarnatum, T. squarrosum, T. alexandrinum*), and all are sown separately. *T. incarnatum* is only used for fodder and cut once per season. *T. alexandrinum* is cut twice, once for fodder and once for seed. However, if the seed is not to be collected, then it is left for pasture, ploughed under and then the field is sown to wheat producing an excellent subsequent crop (Tolve, 60 year old mixed farmer).

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[19] There was wild clover in the wheat, but it died before the grain was harvested (*"C'era il trifoglio selvatico nel grano, ma moriva prima della raccolta del grano"*) (Oppido Lucano, 81 year old agricultural labourer), which is to say that the clover had finished its reproductive cycle before the wheat was ripe, having already gone to seed.

Soft-Bread Wheat (*Triticum aestivum*) & Hard-Durum Wheat (*Triticum durum*)

Wheat has always held a central place in Mediterranean farming. Although its primary importance is as food, its straw serves as fodder for livestock, its stubbles are an important source of forage, and when a wheat crop fails, whether because of frost or drought, it universally is used as pasture. However, in the case of a drought year producing a dwarfed wheat, this wheat was so valued that should it have formed a grain head, it was harvested. Where there was no grain head, or if the grains had not filled out, then these fields serve as pasture. In Basilicata (and Apulia), a positive wheat yield is the measure of a successful farming season. Two main types of wheat prevail, soft ("bread") wheat, and durum or hard wheat. Both types are used in bread making.[20]

The *"Marzood"* variety of hard wheat is sown in March as the name suggests (*marzo* means March) and harvested in June, one informant reciting the proverb: *"Semina quando vuoi 'cca a giugno si miete"* (Sow when you want, because in June is the harvest, Oppido Lucano 80 year old farmer/agricultural worker). Those with animals grazed the *Marzood* or cut it for hay if it did not ripen before the summer drought, although a farmer pointed out that under Mussolini, this practise was forbidden. If it failed (did not ripen), it was harvested nonetheless and milled for feed (*sfarinato*) (Oppido Lucano 74 year old farmer). Also known as *"la Saraodett"*, this wheat was more commonly cultivated in Basilicata in the past than it is today, typically sown into "tired" soils (Oppido Lucano 74 year old farmer). During my stay in Oppido, I saw it cultivated only on one small (*c.* 25 m^2) field at *c.* 600 m a.s.l.. However, its use is more common in Cancellara and is reported to be a crop particularly popular around Vaglio. Cultivation of *la Marzood* and bread wheat appears to be characteristic of mountainous zones, where the spring wheat also serves as a risk averting crop.

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[20] A third type (only noted once) was described as an intermediate form, between hard and soft wheat, called in the Bella area "*La Marzoccolla*". It is described as having long awns (*c.* 15-20 cm) and a black grain head. Apparently, it has fallen out of favour because it is difficult to harvest.

With reference to bread wheat, one informant observed that, "in the past bread wheat was more commonly cultivated than hard wheat, because it resists cold more than does hard wheat" (*"[p]rima si usava di più il grano tenero, che resistiva il freddo, invece del grano duro"*) (Cancellara, 61 year old farmer). The wheat of choice also in Anzi, San Cataldo and environs, and Calvello, informants also described bread wheat as less demanding of fertile soils than hard wheat. Emphasized however, was the fact that yield always depends on soil quality: that is, bread wheat yield was inferior in the less fertile soils than that of hard wheat in the more fertile soils. Informants reported that the most fertile soils traditionally are dedicated to growing wheat (*Triticum durum* and *T. aestivum*), whereas less fertile soils are put under hay or another form of fallow, or to oats or barley. Bread wheat is also reported to have been the dominant wheat sown in environs of Minervino Murge, Apulia. Its replacement by durum wheat is attributed by informants to the program of state subsidies. This area is significantly drier and more prone to droughts than the mountain communities of Basilicata. The traditionally favoured cultivation of bread wheat in this area (the most popular varieties known as *"Tira Dritto"*, *"La Maionica"*) is a reflection of the crop's greater yields than the hard wheat in the less fertile soils, despite greater aridity.

The most popular of the hard wheats (*Triticum durum*) identified by informants are the *"Cappelli"* (*"il Cappello"*) and *"Grano Forte/Rosso"*. The *Cappelli* were introduced during the first decades of this century, replacing varieties known as *"La Carlontina"* and *"La Siciliana"*, and were almost universally cultivated in Basilicata for 40 years. These varieties are characterized by large grain heads and long awns, but also tending to a long stalks and hence lodging. When sown for extended periods, they have the reputation for "bastardizing" -- of growing too tall which necessitated the use of flocks to graze back the growing wheat during February and March in order to avoid lodging (e.g. Oppido Lucano, *c.* 68 year old mixed farmer). Rarely cultivated today, they are still grown in the San Cataldo di Bella area. Reportedly introduced to the Oppido area in the first decades of this century, (reported dates of introduction vary with informant from 1915, 1920-25, to *c.* 1930-31), the *Cappelli* replaced other hard wheats, such as the *"Siciliana"* and *"Carlontina"* wheats identified by informants as popular around Oppido. These are standardized varieties, and as Achille Grimaldi (1979, below) observes, little of the true traditional wheats remain.

The old populations of southern Italy: the *Saragolle*, the *Russello* and the *Timilia*,

> have disappeared, leaving in their place homogenous types based on single, pure lines, and obtained through plant genetic improvement methods (Grimaldi 1979:12, translated).

The *Cappelli* varieties of hard wheat produce a flour high in semola[21] content which makes exceptionally tasty bread which largely accounts for its popularity. However, another reason for the popularity of these wheats became evident in the descriptions of these as extremely tall growing, majestic wheats.[22] Currently available seed wheats (e.g. *"Simeto"* variety) are selected for short stems which cannot be grazed by flocks as had been the case with past varieties of wheat. Thus, part of the nostalgia for the *Cappelli* and other wheat varieties was their tendency to grow tall which permitted grazing and all the associated benefits of having flocks in the arable (described in Chapter 6). A practise for managing growth, informants reported that in order to avoid all stem and leaf growth with little grain head, sheep would be sent out to graze back the growth. Where there was more precipitation or a more humid environment, the growth would require repeated grazing. For this reason, informants remarked, sheep were always grazed along the Bradano River. 1933 and 1950 were noted as having been excellent years for the *Cappello*, whereas the years following 1950 (1952 is reported to have been an especially bad drought year) were too dry to produce a good crop and *Cappello* production declined.

The most widely distributed wheat seed among the communities, and purchased from local agricultural consortia, is the "Simeto" variety. According to one vendor, the seed is comes from Bologna. The new regulations for claiming the hard wheat subsidy require that farmers return the empty official seed bags. Consequently, there is no individual seed selection: if one wishes to claim the subsidy, one must purchase the variety distributed through the consortia.

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[21] Semola (semolina) is "[a]n article of food consisting of those hard portions of 'flinty' wheat which resist the action of the millstones and are collected in the form of rounded grains" (Oxford English Dictionary 1973:1937).

[22] Grimaldi (1979:13) reports the *Cappelli* wheats to grow to 130-140 cm. Informants noted that after several years' cultivation it grew up to *c.* 2 m -- the seed became bastardized (*"il seme imbastardiva, non si manteneva basso come prima"*) -- and farmers would switch seed from one field to another in order to mitigate this process.

Barley and Oats

Both barley and oats were and continue to be important pasture, hay and grain crops throughout Basilicata. Sown either separately or together as pasture (*foraggine*), barley and oats are valuable risk-mitigating crops, their use over the year is flexible, responding to the growth conditions of pasture resources. Described above, barley and oats are also constituents of hay maslin crops, sown together with forage legumes. Sheep are said to prefer oat hay because it has less awn than other cereals (Oppido Lucano, 64 year old mixed farmer). No variations in practise or use of the crops emerged from the interviews between communities at different elevations.

Barley was traditionally and is still given as feed to supplement the diet of ewes during lambing (Calvello, 78 year old mixed farmer). This appears to be a universal strategy today. Both barley and oats, like wheat, are grazed until the first node emergence (at which point the grain head begins to develop). Mixed farmers and *pastori* alike commented that in grazing cereals, flocks are selective in their grazing, the animals seek out the spontaneous flora. For example, oats are described as being "cleaned" by sheep put in to graze out the spontaneous flora. The informant showed me the product of this treatment, oats which had only few seeds of spontaneous plants despite not having been treated with herbicides (Oppido Lucano, 71 year old mixed farmer, Bradano plain).

A number of changes in barley production were identified by informants. For instance, traditionally, barley is reported to have been associated more with pig production than it is today. Also, some producers of hard wheat seed have stopped cultivating barley because of problems arising from the persistence of barley in soils. Barley tends to linger in the soil and come up during following wheat crops. Because the seeds of barley and wheat are the same in size and density, they cannot be separated out of the grain. Other seeds, like oats, are easily removed with the *svecciatore*[23] which separates out the "impurities". Barley was always sown, however, until hard wheat for seed began to be cultivated (Oppido Lucano, 64 year old mixed farmer). Another change in barley cultivation has been the introduction of a new variety of barley, a malting barley known locally as *"orzo beer"* (Oppido Lucano, 70 year old mixed farmer). This barley is cultivated for sale rather than being sown specifically for domestic use as animal feed and pasture. Changes parallelling those in wheat varieties have occurred also with barley seed. Seed sold through the consortia are no longer the local types (*"nostrane"*) -- a barley which is described as having awns snug to the grain head (*"arista vicino"*).

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[23] "De-vetcher" – the machine used to "clean" seed by selecting-out different-sized and weight seed, a tumbler-like instrument in appearance.

The flexibility of these crops is apparent in the uses made of a single crop. A barley and oat field may serve only as pasture, or as pasture and hay, or as pasture and a grain crop. The inclusion of forage legumes yields a pasture and/or hay crop. Illustrated below, the ability to choose between these various production goals over the course of a single season, is a valuable tool in mitigating risk -- both in crop and livestock production.

Foraggine

The *foraggine* is a sown pasture, typically composed of barley and oats sown together, and frequently with forage legumes, particularly vetch. This fallow crop serves as pasture for sick, weak livestock as well as lambs, kids, lactating ewes and does (female goats). Located close to the animal pens and typically enclosed, selected animals are put in for an early graze, and/or an additional period of grazing upon returning from the grazing round (described in Chapter 5). Alternatively, the selected animals may be left in the *foraggine* throughout the grazing day.

In Calvello as is the predominant pattern throughout Basilicata, the *ferracine* (dialect for *foraggine*) is composed of a mixture of oats, barley and vetch. In Abriola oats and vetch are especially used together. Importantly, all sorts of seeds can be and are frequently top seeded into this maslin. For example, the maslin crop for *foraggine* in the Cancellara area included wild peas (*Lathyrus* sp.), wild vetch and common vetch, oats and lentils. Similarly, in the Oppido area, barley is sown in with wild oats as *foraggine* for sheep. An appreciated fodder which traditionally always has been used to feed sheep, eating the wild oats is said to make sheep produce more milk (e.g. Oppido Lucano, 71 year old mixed farmer, Bradano plain). Significant here are evident parallels between top seeded *foraggine* and spontaneous hay in bare fallow which may be top seeded.

> Oats and barley were put in -- the *foraggine* was a pasture made to fatten the sheep, to make the lambs bigger, but we did not put much in. The large part [of

> pasture] was all untilled stuff (*"Si metteva l'avena,orzo – la ferracina che era un pascolo fatto per ingrassare le pecore, per fare gli agnelli più grandi, ma non si metteva troppo. La maggior parte era tutta robba incolta"*) (Tolve 60 year old mixed farmer).

In the San Cataldo area, hard wheat or bread wheat and oats were traditionally sown together as *foraggine* (*vurrascienn'* in the local dialect). If the growing season was good, and pasture resources were sufficient, the wheat and oats, having been grazed until the first internode appeared on the wheat and oat stems, would be protected from grazing and allowed to ripen as a grain crop. If not, these would continue to serve as pasture (San Cataldo, 69 year old mixed farmer).

Where barley and oats are sown as grain crops, they are nevertheless grazed. Parallelling the grazing of wheat, for example, in the Irsina area barley and oats are grazed until the end of March, beginning of April (Irsina, *c.* 55 and 60 year old mixed farmers). The difference between this and the *foraggine* is the intended purpose at sowing (and the placement of the *foraggine*). Although both may turn out as grain crops, both serve as pasture, both might be used for hay, and in instances of crop failure, the sown fields of barley and of oats become pasture. This, and the example of top seeding of *foraggine* and the parallels to spontaneous hay from bare fallow, serve to illustrate both the risk-mitigating, flexible roles of these crops in Basilicatan agriculture and pastoralism, and the continuum between spontaneous and sown crops.

Pandone

Parallels can also be drawn between the *foraggine* and the *pandone* which consists of unsown pasture, those areas adjacent to the farm buildings (*"accanto i locali"*, Abriola, 63 year old mixed farmer), typically amounting to less than half a hectare. Unlike the *foraggine* which is tends to be an enclosed field, the *pandone* is typically not sown pasture, but instead is composed entirely of spontaneous growth. The *pandone* differs from grazing on other, untilled, spontaneous pasture because it is at the farm site, convenient for grazing, but also as a source of hay if the year produces abundant forage (Calvello, 78 year old mixed farmer). The *pandone* is selected amongst the lands around the farm buildings, informants specifying that it should not be steep-sloped for ease in haying.

The main input in the *pandone* is manure. The animals fertilize as they graze, but manure collected from stalls (*jazzi*) may also be added, although arable lands are given priority for this fertilizer (Oppido Lucano, 58 year old *pastore mezzadro*). Alternatively, the *pandone* is fertilized using a summer *cortiglia* (the penning of flocks overnight, described below). "Manure brings too many grasses, it was put in the *pandone*" (*"Letame porta tropp'erba – si metteva nel pandone"*) (Cancellara, 89 year old mixed farmer). "Manure always produces grass growth. It produces [throws] good grasses" (*"Letame fa crescere l'erba smpre. Butta erba buona"*) (Cancellara, 60 year old mixed farmer).

Several informants describe the *pandone* as a convenient pasture of spontaneous forage which was manured, cleaned by prescribed burning, and of sufficiently high quality to be protected from grazing after April in order to cut hay (e.g. Cancellara, 84 year old mixed farmer; Vaglio 58 year old mixed farmer). In their use of the term, it does not refer restrictively to those lands adjacent to farm buildings. This was the case particularly among informants in the Tolve and Oppido Lucano areas. Most mixed farmers and *pastori*, however, consider the *pandone* to be restricted to lands around the *masseria*.

Furthermore, like the *foraggine*, seeds recovered from grain cleaning (from the *cernicchio* -- a kind of sieve) after threshing may be broadcast top seeded (Cancellara, 65 year old widow of mixed farmer). Vetch or clover might also be sown into the *pandone*, and any other "leftover" seed to augment the pasture/hay (Vaglio, 73 year old mixed farmer). A Tolve mixed farmer described top seeding common vetch into a manured *pandone*, and then passing over with a disc harrow to incorporate manure and vetch (Tolve, 43 year old mixed farmer). In the *pandone* grew medicks (*"trifoglio piccolo"*), wild *sulla* and wild vetches. To this group is added *"lu sciuoglie"* (*Lolium* sp. - darnel) (Tolve 68 year old mixed farmer). "All types of grasses grow in the *pandone*, especially legumes" (Cancellara, 82 year old mixed farmer).

The *pandone* is used especially for pasture during wet weather, because flocks cannot be put into the fields as their hooves gouge holes in sown arable (Cancellara, 71 year old mixed farmer). It is also reported to have been used primarily for grazing ewes and does before they gave birth (Cancellara, 73 year old mixed farmer) and horses (Tolve, 46 year old mixed farmer). On several farms and *jazzi*, (sheep and goat folds) the manure heap is kept above the farmyard pasture (*pandone*). This I was told, was to provide further fertility via precipitation leaching nutrients which drain directly into the *pandone* below. In August through September, manure is spread onto fields as fertilizer, particularly where hay shall be sown. Sheep and goat manure is applied to all fields whereas cattle and horse manure was reportedly restricted for use to the *pandone* and to fields to be sown to hay: too much spontaneous seed growth from this manure would out-compete a cereal crop (Oppido Lucano, 58 year old *pastore*).

Manure

All livestock dung is considered beneficial not only as a fertilizer, but in preserving moisture and in germinating grasses in spring. Rather than undertaking the more labour-intensive *cortiglia* (described below), some farmers spread manure in the fields and put in hay to strengthen (fatten) the soils (Tolve 45 year old *pastore*). In mid-summer manure collected from the stalls is spread onto fields with low fertility. In sandy soils, this manure is most valuable (Oppido Lucano, 85 year old mixed farmer).

Another informant emphasized that they avoided putting fresh manure on their fields, describing how having spread the previous year's (aged) manure as fertilizer, too many seeds still germinated from the manure. "Dung is spread wherever forage was grown . . . . Manure brings lots of grasses" (*"Buttato sempre dove faceva il foraggio. . . . Letame porta molt'erba"*) (Cancellara, 67 year old mixed farmer).

Traditionally, manure was taken by sled, locally called a *strascine* (Plate 15), to be spread with a pitchfork onto all arable lands (Tolve, 67 year old mixed farmer). The current restricted application of manure selectively on lands to be sown to hay or pasture also reflects the change to less labour intensive practises, although past practise described by informants indicates that manure was most commonly applied on land to be sown to hay -- the fallow -- then followed by wheat, then oats or barley. Where wheat was sown in manured lands, women were hired to remove the spontaneous growth by hand (pulled) or using small hoes (Cancellara, 65 year old widow of mixed farmer) (see also Koster 1977:359-360 for Greek example). Agrochemical (industrial) fertilizers have largely taken the place of the *sovescia* (green manuring) and of manuring fields to be sown to wheat.

Cortiglia

Several informants "never used green manure [the *sovescia*] because [they] always had sheep", the mixed flocks were put onto arable land to fertilize the soils (e.g. Irsina, 55 and 60 year old mixed farmers). Traditionally, the *cortiglia*, a formalized system for the direct manuring of fields, was universally practised by those with numerous sheep and goats. Flocks are penned overnight on fields, the location of the pens typically were shifted every night or every second night (depending upon the number of animals). In the morning, the *pastore* shifted the enclosure adjacent to where the sheep had been the night before. This method of fertilizing concentrates dung and urine on soils. Urine is also an important to fertilizing -- the high phosphorous content of urine is a necessary substance for the growth of legumes. A further 'service' undertaken by flocks is to "clean" the land under *cortiglia*. When flocks graze an area, they eat all the "wild", spontaneous growth, especially true of the *cortiglia* where grazing is restricted to a limited area and all growth is, as a result, razed to the ground.

Undertaken "to "fatten" the soil" (*"Si usava per ingrassare la terra"*) (Cancellara, 82 year old mixed farmer), land-poor households did not use this method because of insufficient animals, but would spread manure collected from their few livestock on their arable land. However, in the absence of sufficient animals to undertake the *cortiglia*, also reported was the pooling of flocks for this purpose. Various owners of small flocks of sheep would amalgamate their flocks, agreeing on a grazing and *cortiglia* schedule. One week the sheep would be put into the *cortiglia ricinto* (pen) on one owner's land, the next on another's, undertaken from May to October in the Cancellara area (Cancellara, 82 year old mixed farmer). Once April arrived the animals began to be put overnight in enclosures which were shifted the next morning on fallow fields and ploughed fields in preparation for sowing (Oppido Lucano, 83 year old *pastore salariato*/mixed farmer). This was ongoing until November weather permitting (Cancellara, 67 year old mixed farmer).

Similarly, in the environs of Bella, informants described an organized, communal, systematic manuring of arable. To illustrate, they provided the example of ten *pastori* combining their flocks. All the sheep would be grazed on each *pastore*'s land in rotation of *c.* 20 days to fertilize these soils. The cheese produced from the pooled milk would be sold to one buyer, and the profits divided according to the number of sheep each *pastore* contributed (Bella, group interview).

The *cortiglia* traditionally was used extensively in the environs of Vaglio. Each year, mixed farmers put a couple of hectares under the *cortiglia*, considered the best fertilizer in this area where no use is made of green manure because of the threat of drought and the harsh winters encourage the collection of the maximum hay for winter fodder (Vaglio, 73 year old mixed farmer). The same applies in Calvello and Abriola, where the *cortiglia* was always undertaken: sheep and goats were put two nights on each portion of the least fertile land (Abriola and Calvello, group interviews). The movement of flocks across 'bare' fallow also serves to fertilize, albeit in less concentrated amounts. Sheep and goats control the spontaneous growth that emerges between ploughing by grazing the 'bare' fallow, simultaneously incorporating their own manure, informants noted, while performing "little ploughings" with their hooves.

Although the *cortiglia* was undertaken mostly to fertilize lands in preparation for sowing wheat, it was also used to fertilize fields to be sown to hay (e.g. Oppido Lucano, 58 year old *pastore mezzadro*; Cancellara, 71 year old mixed farmer). Once April arrived the animals began to be put overnight in enclosures which were shifted the next morning. Another informant observed that his grandfather always kept 4-6 hectares under the *cortiglia* in a form of bare fallow. These areas would produce deluxe spontaneous growth up to a meter in height by the month of May-June, which then served as pasture (Cancellara, 73 year old mixed farmer). One informant noted that flocks transport *lassane* (*Sinapis* sp.) from other areas into fields when kept in the *cortiglia*.[24] The same informant asserted that wheat could only be grazed where they had used the *cortiglia*, because those were the only terrains that produced sufficient growth to allow grazing (Cancellara, 62 year old farmer).

In other microclimates, the period for undertaking the *cortiglia* varied. For instance, in cooler areas (at higher elevations) the summer *cortiglia* was undertaken from July through to October in preparation for sowing cereals (Tolve, 68 year old mixed farmer), or from June to September (Avigliano-Cancellara, 78 year old widow of mixed farmer). Others used the *cortiglia* on bare fallow fields during spring and winter (Cancellara, 84 year old mixed farmer).

Oppido *pastori* also emphasized the past importance of the *cortiglia* for 'fattening soils' (Oppido Lucano, 83 year old *pastore salariato/*mixed farmer). The *cortiglia* began in April on the fallow and in the stubbles after they had been burned, but always before sowing. One informant noted that his family made little use of the *cortiglia* out of fear of thieves. Instead, the family took manure out onto the fields. Fears aside, the informant acknowledged the value of the *cortiglia* not only in fertilizing, but also in reducing the clods of earth (*zolle*): "Of a well-trodden field one says: "What did you do -- the *cortiglia?*" (*"Di un terreno molto calpestato si dice: 'Che hai fatto -- la cortiglia?'"*) (Oppido Lucano, 71 year old mixed farmer).

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[24] Another cause of the spread of *lassane* into his property, this informant proposes, is the transport of these seeds into his terrains by the combine hired to harvest and thresh his grain (Cancellara, 62 year old farmer).

These same practises hold true for the Tolve area. There, the *cortiglia* traditionally was used extensively to manure all arable land, whether to be sown to wheat, oats, barley or legumes for forage/hay. Now, because of the cost of labour, it is no longer undertaken and purchased, industrial, chemical fertilizers are applied instead. Nevertheless, manure is still spread on lands destined for hay or *foraggine* (Tolve, 67 year old mixed farmer).

Sheep and Goat Breeds

Breeds are selected for the broader environment: climate, vegetation and for their productive characteristics. Two breeds of sheep predominate in the study area: Comisana and Gentile di Puglia. The Comisana breed originates from Comiso (Raguso province), Sicily. Its ancestors have been traced to East Asia, introduced probably in through trade during the early Roman Empire in its expansion into Asia Minor (Portolano 1987:42). This breed is recognized primarily for milk production, and secondarily for meat. Its wool is considered to be of lesser quality, and while used to stuff mattresses, it is not sought out by the textile industry (Portolano 1987:37). Pure breed Comisana animals noted in the Oppido area also retain the archaic characteristic of shedding their wool, which can be pulled by hand rather than sheared. Sixteen months is the average age for the first lambing for ewes which predominantly birth twins on an annual basis (Sanna 1992:116). The Siciliana is well adapted to hot and arid environments, its wool is of little value, but it is favoured for its abundant milk production. It is also recognized for its rapid growth, its adaptation to the mediterranean climate and efficient use of spontaneous pasture vegetation (Portolano 1987:37,42,44), the Comisana is favoured throughout much of Basilicata and is typically cross-bred with Gentile di Puglia.

Gentile di Puglia breed animals originate in Apulia during the 14th century and the legislated transhumance instigated by the push to compete in the European wool market. They are a cross between the Spanish Merinos breed which was introduced to Spain by Berber populations (Rubino 1994:132) and the local sheep breeds (Sarti 1992:246). During the 14th century they were raised primarily for wool and secondarily for their meat and milk. The collapse of the wool market in southern Italy in recent years has resulted in a switch in productive emphasis and this breed is now raised primarily for meat (Rubino 1994:45; Sarti 1992:246). These rugged Merinos-local cross breeds are suited to periods of stress and poor pastures (Rubino 1994:45). The better quality wool and higher meat production of the Gentile di Puglia combines rather well with the greater milk and lamb production of the Comisana. Most flocks in the area are composed of crossbred individuals.

Also common in Basilicata are the Spanish Merinos breed sheep, introduced primarily for its wool, a product which is no longer marketable because of competition, local knowledge has it, from the Australian sheep ranchers, synthetic textiles, and locally, the replacement of wool mattresses and pillows by purchased, factory made box spring mattresses and foam pillows.

The only other breed encountered in any significant numbers is the Bergamasca, individuals of which are kept in flocks composed of Gentile di Puglia and Comisana breeds. The Bergamasca is of larger stature than either of the others, similar in appearance to the Merinos, but of a larger build and therefore selected for its meat production. Its origins have been ascribed tentatively to *Ovis aries sudanica* (Sarti 1992:243).

Sheep breeds are selected by Basilicata shepherds for their productive value. First and foremost, they must be adapted to the traditional grazing system and resources. Breeds selected for under stall-based feeding systems are not favoured because of their reliance upon domesticated hay crops, and their consequent disinterest in and inability to process the spontaneous and varied forage of the pasture areas. Sheep and goats within each flock have been selected for flock reproduction on the basis of their productivity under the grazing system and on the particular pasture resources frequented.

In the Calvello area, sheep are largely Merinos crossed with Gentile, Comisane, and/or Foggiane. There is a local breed of sheep that only does well in the mountains, called locally Marsicone. These are small of stature -- informants indicated about half the size of a Comisana. The goats in the area are all local (*"nostrale"*), Garganica breed.[25] In the San Cataldo area, the sheep selected for this zone are an ecotype of Merinos-Gentile cross. The Comisana breed is not suited to this zone. In the Oppido, Tolve and Cancellara areas however, flocks are dominated by Merinos-Comisana cross animals.

The "Local" breed dominates the goat population. It is the most widespread breed in Italy and of regional genetic variability; it is the Italian "Heinz 57" goat. Ecotypes of this breed are noted and it displays the characteristics of the most dominant breed with which it has been crossed (Rubino 1990:27, 35). Commonly the "Local" breed is crossed with the Ionica breed in Basilicata. However, phenotypes are highly variable. These goats are exceptionally well adapted to their environment, are great milk producers and breed prolifically, commonly producing twins and even triplets. The Ionica breed is a heavier (larger) animal which produces milk with a higher fat content and is considered generally as a Maltese goat breed. Maltese goats are also present in the area and are small of stature. Considered the most archaic and least productive breed in the zone, the Garganica is also present in Basilicata (Rubino 1990:32). However, most goats in the study area fit into the "Local" type breed.

In the Minervino Murge area, the goats are of the Garganica (local) breed which dominates throughout the communities visited. The sheep are cross-bred Comisana, Altamurana (local breed), Leccese and Sarda breeds. In the Irsina area, the favoured breed is currently Gentile di Puglia and Isle de France rams with a few Comisana-breed ewes for their milk production. The main production goal is meat, and the newly introduced, Isle de France breed is larger in stature than the Gentile breed (the Bergamasca breed is reported not to do well in this zone).

Over the years, *pastori* have selected from their herd the best animals (i.e. those that "do well") -- that produce abundantly of milk and meat (relative to the breed) in a given environment. The animals have thus been selected for their capacity to consume and metabolize effectively the locally available spontaneous vegetation (local ecotypes). However, with the State subsidies (and hence, reduced risk), more producers are experimenting with new, imported breeds which tend to require stall feeding.

Traditionally, all *pastori* selected herd animals (genetic selection) on the basis of a careful evaluation of each individual animal's productivity on the particular pastures at the *pastore*'s disposal. A Tolve *pastore* was emphatic about the problems of moving animals to new environments: that they suffer from the change which is immediately apparent in weight loss and decreased milk production, and which might lead to death. "They are accustomed to a place, to the mountain, to the forest" (*"Se si portano queste pecore da un'altra parte, possano morire . . . sono abituate al posto – alla montagna, al bosco"*) (Tolve, 75 year old mixed farmer). Consequently, selected out of the flocks (culled) are those animals which are the least productive and weakest individuals.

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[25] The preponderance of Basilicata town households which had the means to keep a couple of sheep and goats did so. Most households had at least one goat for milk, the milk from which would be pooled with others to make cheese and ricotta by turns.

Culling to reduce flock size during forage shortages is not practised consistently. In the Calvello area there was little use of culling flocks during years of poor pasture growth or of too lengthy snow accumulation -- a bad year (*"la mal annata"*). Generally, when a bad year occurred a few animals would die of starvation, those in better health with greater body reserves of fat would pull through (Calvello, 78 year old mixed farmer and 73 year old agricultural labourer). In this way, those individuals with a greater capacity to metabolize efficiently the broadest variety of available vegetation (local ecotypes) are most likely to survive. The same practise occurred the winter of 1994 in the Minervino Murge area where many sheep died over the winter. In the past, old rams and ewes would be culled and the meat sold (Minervino Murge, 64 year old mixed farmer).

In a drought year, Irsina area *pastori* (and mixed farmers) cull all old sheep from flock to reduce the number of animals. Those with lands along the Bradano tend to be less at risk because the area is wetter and as the Bradano dries, it recedes, allowing access to previously untouched islands of vegetation.

Because of the greater aridity in the Minervino Murge zone, and less fertile soils, it is worth elaborating on what I propose are some consequences of these differences. Untilled (and untillable), rocky pasture (the Murge) dominates, but also includes fallow fields. Grazing cereals and legumes is also undertaken in this area, but is extremely costly to *pastori*. Where many Oppido *pastori* today do not pay for the grazing of others' fallow lands and stubbles, as well as uncultivated pasture, in Apulia the opposite is the case. Payment is exorbitant and established by the landowner who may demand lambs or cheese. For instance, I witnessed a transaction between a landowner and a *pastore*'s wife during which the landowner had dropped off four large (empty) cheese containers to be filled (two days' cheese production) in exchange for the right to graze a small field in bare fallow. Considering that this was just one of several private individuals from whom the *pastore* rents pasture, the cost is steep. The *pastore* acknowledged that the extortionate rates were even worse in the past. In this area, olive trimmings, oak leaves and straw are regularly used to supplement grazing.

Conversely, in the environs of Tolve, where animals were being grazed widely, payment for use of pasture is likely to be a few baskets of ricotta or a round of cheese depending on the size and quality of the land. A lamb is an appropriate exchange for grazing a five-year fallow field. With reference to such exchanges, the mixed farmer justified the low cost by noting that the flocks play an important role in the maintaining the quality of the arable.

> Land being grazed is kept cleaner, and the soils are enriched with manure and urine. The wild grasses to not increase -- the sheep hold them [back]" ("*Si mantiene più pulito il terreno in pascolo, pure il terreno si arrichisce con letame e l'urina. Le erbette selvatiche non aumentano -- le pecore li mantengano*") (Tolve, 60 year old mixed farmer).

Sheep and Goats as Tools

> One October, in the environs of Irsina, it rained all month. As a result, the soils were too wet to plough. Therefore, they sowed hard wheat and then sent in sheep to tread the seed into the soil. They had an excellent harvest . . . many used this system. ("*Un ottobre, nella zona di Irsina, ha piovuto tutt'il mese. Allora il terreno era troppo bagnato per arrare. Cosí hanno seminato il grano duro e poi hanno mandato dentro le pecore per calperstare i semi nel terreno. Hanno fatto una ottima raccolta. . . . molta gente usava questo sistema*") (Oppido Lucano, 60 year old mixed farmer).

In addition to the examples described above, the functional role of sheep and goats integrates pastoralism and agriculture in this area. Illustrated also in the example above, sheep and goats' hooves were used to set seed especially in the plains on those occasions when the soils were too wet to use machinery (Oppido Lucano, 71 year old mixed farmer, Bradano plain). Sheep's hooves also serve to stir up soil after sowing (Oppido Lucano, 83 year old *pastore salariato*/mixed farmer), "sheep work the soil" ("*le pecore calpestano la terra --la lavorano*) (Oppido Lucano, 69 year old agricultural labourer). Another informant described action of sheep's hooves while grazing cereals as "*sarchiatura*" (Abriola, 63 year old mixed farmer).[26] "The indentations created by the sheep [and goats'] hooves in [amongst] the cereals . . . in walking they move those two fingers' [depth] of soil and aid the [cereal] growth" (*"I fori creati dalle zampe di pecore e capre nei cereali ... a fino di caminare muovano quelle due dite di terreno [superficie] e aiutano la crescita"*) (Tolve 45 year old *pastore*). They aerate, work the soil, and the informant added, also "plant" their own manure/urine (ibid.) -- universally acknowledged, flocks fertilize as they graze, and the stall-collected manure is used to fertilize fields and vegetable gardens (*ortaggi*). Manure also improves soil structure and therefore the soil's ability to retain moisture (Oppido Lucano *c.* year old *pastore*).

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[26] Cultivation technique involving the shifting of the soil surface ("*Tecnica colturale consistente nello smuovere la superficie del terreno . . .*" (Venturi 1977:202).

Discussed also in the context of sown and spontaneous crops (above), sheep and goats are used to control weed growth, consuming spontaneous plants in fallow as they graze and thereby reducing their dissemination. "Sheep clean the soils if they are always there, the [spontaneous] plants do not produce fruit" (*"Le pecore fanno pulita la terra se stanno sempre la -- l'erba non porta frutto"*) (Oppido Lucano, 85 year old mixed farmer). They also hold back growth in stubbles until they are burned, helping to insure a thorough burn. That flocks act as herbicides (*"diserbanti"*), led one informant to observe that those who begrudge the (unsolicited/unpaid) grazing on their fields are fools because the animals not only fertilize as they graze, but they help to reduce (they "clean") the growth of spontaneous plants emergent in the subsequent wheat crop (Oppido Lucano 58 year old *pastore mezzadro*). Another informant spoke of leaving a portion of stubbles unburned for pasture until the end of March -- a bare fallow. Intensively grazed, the sheep and goats' hooves broke up the stubbles as they grazed, stubbles which were ploughed, turning under the manure produced during grazing (Oppido Lucano, 85 year old mixed farmer). *Pastori* take their flocks to graze others' lands under fallow to control spontaneous growth at the owners' request. Wild grasses do not increase as the sheep hold them back with their grazing.

> The soil is kept cleaner under grazing, it is also enriched by the manure and urine. The wild grasses do not increase, the sheep hold them back" (*"Si mantiene più pulito il terreno in pascolo, pure il terreno si arrichisce con letame e l'urina. Le erbette selvatiche non aumentano -- le pecore li mantengano"*) (Tolve 60 year old mixed farmer).

Grazing the flocks on cereals is a universally recognized means of increasing tillering, avoiding lodging, and too much stem/leaf growth in cereals. With reference to tillering, a mixed farmer in the Oppido area added that if cereals produced abundant tillers, this reduces competing spontaneous growth. "There are no wild grasses ("weeds") if there is good tillering" (*"Non c'è nemeno erba selvatica quando c'è l'accestimento buono"*) (Oppido Lucano, 65 year old mixed farmer). This may be a combined result of sheep and goats grazing spontaneous growth as many *pastori* noted that their flocks are particularly attracted to the spontaneous plants in amongst the wheat, as well as the physical effects of tillering in reducing other, competing plants' access to light and water. Sheep and goats grazing in cereals and legumes (for seed) act as herbicides (keep down population of infestants). *"...sono diserbanti per i cereali. Mangiano tutte le erbe che non ci devano stare dentro"* (Tolve, 47 year old mixed farmer).

Sheep and goats were especially important in the past to graze back cereals in order to avoid lodging. This grazing also induced tillering (*". . . accestimento – hai voglia!"*) (Oppido Lucano, 71 year old mixed farmer). During March and April, flocks were taken to graze in the sown arable to reduce 'weed' growth and to hold back the cereals. "Sheep [and goats] were put to graze sown fields so that the wheat did not develop just leaves and stem" (*"Si mettevano apposto le pecore nello seminato cosí il grano non faceva tutto foglie e fusto"*) (Oppido Lucano, 70 year old mixed farmer). Most informants emphasized that grazing cereals had to be "light", perhaps an hour in the morning, an hour in the evening (e.g. Avigliano-Cancellara, 78 and 44 year old mother and daughter, farming household). One informant argued that wheat was only grazed if it had become too tall in March, and then, only by goats which nip off the tips (*"Si faceva ammuzzare nu pique – ma solo dalle capre che spuntano la punta"*) (Cancellara, 79 year old mixed farmer).

Finally, sheep and goat flocks are reported to help cereals recover after freezing or hail/snows storms which have flattened the crop. In these instances, *pastori* are asked to graze their flocks on such fields in the hopes of recovering the crop. This is particularly the case with barley which is helped to recover by the animals which fertilize the field and promote tillering of the plants (Tolve, 45 year old *pastore*).

Burning

Described in greater detail in Chapter 5, prescribed burning is undertaken in untilled pasture lands, in forests, along rivers and in arable lands – the burning of cereal stubbles. Traditionally a universal practise throughout Basilicata and Apulia, cereal stubbles are burned primarily to facilitate ploughing. Despite government agronomists' efforts to discourage this practise, the vast majority of farmers and mixed farmers persist in burning stubbles. Stubble burning was especially essential in the past because plough depth reached only a maximum of 25 cm.[27] Consequently, stubbles remained on the surface, interfering not only with ploughing, but also with sowing. Furthermore, soils tend to be dry throughout the summer and early fall, hence the stubbles do not decompose (Oppido Lucano, 64 year old mixed farmer, Bradano plain). Informants also spoke of burning stubbles to reduce spontaneous plant growth by burning some seeds, to reduce plant diseases (Oppido Lucano, 80 year old agricultural labourer) and to reduce insects, such as grasshoppers. For instance, one informant spoke of burned stubbles yielding roasted grasshoppers (*grilli arrostiti*) and locusts (*"verrucole"*) which were greedily consumed by grazing pigs (Oppido Lucano, 72 year old mixed farmer).

Besides limiting infesting insect populations, burning stubbles also serves to propagate fresh growth (*"Si ard e sciutte u nuove"*) (Irsina, *c.* 55 and 60 year old mixed farmers). "In burning stubbles, almost all wild seeds are burned" (*"Quando si brucia la restoccia, si ardano quasi tutti i semi selvatici"*) (Oppido Lucano, 60 year old mixed farmer). A Cancellaran informant responded to questions about burning stubbles with a rebuke: "Of course we must clean the soil" (*"Per forza dobbiamo pulizzare la terra"*) (Cancellara, 65 year old widow of mixed farmer). In the same breath as noting the positive effect of reducing "weeds", all informants remarked that burning fertilizes the spontaneous growth that follows upon the burn, wild oats and clovers particularly. "If you burn the stubbles, clovers return" (*"Se arde la restoccie lu trifoglie viene arrete"*) (Cancellara, 89 year old mixed farmer), or "where they have burned, the indigenous clover emerges" (*"Dove hanno bruciato, il trifoglio nostrale ense"*) (San Cataldo, 62 year old mixed farmer).

Burning is also a means of enhancing soil fertility informants asserted. "Ash was the fertilizer then, it fertilized the soil" (*"La cenere era il concime di allora, concimava la terra"*) (Cancellara, 61 year old mixed farmer). With reference to burning stubbles, one informant recounted how friends in need of straw for their stalls collected straw from his fields for three consecutive years. This informant argued that the drop in soil fertility in those fields from which straw had been collected was related to the lesser amounts of ash to plough into the soils (Oppido Lucano, 65 year old farmer, Bradano plain).[28]

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[27] In the past, plough depth was restricted to a maximum of less than 20 cm with the ard, and to an average depth of 25 cm with the iron share plough.

One informant in the Tolve area (45 year old *pastore*) described his experiment in not burning stubbles, but in turning them under -- an initiative encouraged by Basilicata agronomists. First, he removed as much of the wheat straw as possible before ploughing it under. On this, he sowed barley which began to fail because it froze. The informant hypothesized that straw allowed frost to enter the soil (its bulk creating gaps underground) which damaged the barley. To remedy this situation, he put the sheep/goats on this field, grazing this field all of March. Their hooves trod down the soil which served to remove the underground air pockets created by the wheat stubble, and at the same time, they fertilized the field and in grazing the barley thoroughly, promoted tillering. While the result was a stupendous crop of barley, the *pastore* decided against leaving stubbles and returned to burning.

A spontaneous growth of all types of grasses occurs post-burn. Burns are undertaken when air temperature and moisture are right -- cool and some moisture preferred. The burned stubbles are grazed until they are tilled, and then the sheep are sent into the forest to graze. Burning is undertaken in winter in Calvello where local knowledge has it that the only good burns are winter burns. On dry days in winter, the burn removes the dry herbaceous cover and leaves the seed lying on the soil surface whereupon the plants renew their growth (*"brucia la falloppa e il seme resta sotto [sul suolo] e si rinnova"*) (Calvello, 78 year old mixed farmer).

Informants in the Irsina area commented that stubbles were and are always burned, but that it was a less dangerous practise in the past, because fields were smaller and their was a greater diversity -- a mosaic of fields that were in fallow interspersed with fields of grain. "In the past, fire was more used and better controlled than today" (*"Prima si controllava meglio e si usava di più il fuoco!"*) (Irsina, *c.* 55 and 60 year old mixed farmers).

Fire is used extensively to clean and produce fresh growth both in burned stubbles which sprout fresh growth after burning and a spot of rain, and also used to clean untilled pastures, despite reports that the Irsina area forestry marshal is not particularly understanding in this area[29] and imposes heavy fines. Woods in the Irsina area are cleaned in the usual manner -- by grazing livestock, by cutting out unwanted bushes, by selectively removing mature trees where younger are nearby, and by burning (Irsina, *c.* 45 and 50 year old *pastori*, 55 year old mixed farmer; see Chapter 5). Brush pasture is burned beginning in September-October because August is too hot to undertake controlled burning.

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[28] A further factor in the decreased fertility might be lower temperatures during the burn because of the lesser amount of straw, or simply a less thorough burn which might fail to trigger seed germination in annual legumes, and a loss in their contribution to soil nitrogen (decreased phosphorous also from the burn would have a negative impact upon legumes. Also, with less field residues both before and after burning, livestock would not linger to graze here and the manure and urine they would leave behind would be significantly reduced.

Fire is universally viewed as a tool to enhance pasture, to initiate fresh growth of forage plants in all areas. "Fire makes the place [pasture] more genteel, it brings forth greater amounts of good [valuable] grasses (*"Il fuoco gentilisce il luogo, mena più erbe buone"*) (Cancellara, 67 year old Consequently, fire was (and is) used in arable (stubble burning), in forests, and in untilled open and brush pastures ("nearly everywhere") (Oppido Lucano, *c.* 60 year old mixed farmer). Burning is considered essential in maintaining pastures, and, where stocking rates are low, in opening up or in keeping open brush pastures which otherwise rapidly choke off access to livestock. Where stocking rates are high, burning is less frequently undertaken. "I do not burn here because there is little grass . . . the stocking rate is high so the area is already clean" (*"Non uso bruciare qui perchè c'è poca erba . . . la carica di animali è alta così la zona è già pulita"*) (Tolve, 47 year old mixed farmer).

> Fire softens [makes genteel] the soil. Burning is undertaken where there are useless plants. If a forest is full of thorns, if it is burned, the soil is made genteel -- good grasses result and the remaining plants grow better. It is recommended to burn during winter in dense forests if the winter is dry -- the [fallen] leaves and herbaceous mat are dry. [In a dense forest, the canopy of leaves maintains humidity and inhibits a good burn]. . . . A forest which is not dense is burned in August. If untilled brush [*saldoni*] pastures are burned . . . after two or three years, grasses become bitter if they are not burned -- it becomes ugly -- all dry herbaceous mat [*falloppa*]. It is burned when it is dry, when summer arrives (*Il fuoco aggentilisce la terra. Dove ci sono piante inutile si brucia. Se una foresta è piena di spine, se si brucia, la terra viene aggentilizzata -- erba buona risulta e le piante lasciate vengano meglio. È consigliabile di bruciare durante l'inverno se l'inverno è secco nelle foreste fitte -- le foglie sono secche e pure la falloppa per terra . . . .Una foresta che non è fitta si brucia durante agosto. Si bruciano i saldoni . . . l'erba diventa amara dopo due o tre anni se non si brucia -- diventa*

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[29] The forestry official's reportedly negative attitude may have been inculcated by the burning of pastures under a plantation of poplars which do not resist the flame very well.

> *brutta – tutta falloppa. Si brucia quando è secca, quando arriva l'estate*) (Tolve, 70 year old mixed farmer and 45 year old son -- Podolian breed cattle herders).

Types of plants that are identified as controlled or enhanced by burning are many, notably improved and universally acknowledged as improved are all the legumes (annual and perennial medicks and clovers, vetches, Spanish broom, etc.), and wild cane.

> Wild cane burns all at once (rapidly) and fresh growth emerges rapidly -- the animals go crazy for these canes when the new growth emerges. All plants which are burned are reborn improved. (*"La canna selvatica si brucia in una volta e subito viene crescita fresca ... gli animali vanno matti per questi quando vengano fresche. Tutte le piante quando sono bruciate rinascono meglio"*) (Tolve, 70 year old mixed farmer and 45 year old son -- Podolian breed cattle herders).

Controlled are bramble bushes, the leaves and new shoots of which are grazed, but the branches quickly become unmanageable and impede passage. Areas where these are thick are burned.

Pastori do burn their pastures to enhance productivity in the rocky Murge. Whereas informants were reluctant to discuss burning in pastures, they acknowledged the use of fire in burning stubbles in September- October. In Apulia the legal burning period for stubbles begins September 20.[30] Informants also acknowledged that fire is used in untilled zones -- only small portions burned at any one time (during autumn-winter-early spring) and dependent on the season's *"andamento"* -- fresh growth (Minervino Murge, 64 year old and *c.* 55 year old mixed farmers). The reported poor season's production due to the extended autumn and winter drought suggests that no use of fire would have been made this past winter. However, the localized burns observed in the Murge indicate otherwise. The large part of these appear to have been "cleaning" burns applied to remove unwanted brush and to encourage asparagus production. However, in a couple of locations open grass areas had obviously been burned. Perhaps these burns were used to stimulate fresh growth during the winter forage crisis (Minervino Murge, 64 year old and *c.* 55 year old mixed farmers).

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[30] I have no way of ascertaining if stubbles burned (illegally) before this period begins, although this is more than likely. I had neither the time nor resources to undertake more extensive interviews here

Transhumance

A few people in the Abriola and Calvello area had large enough flocks to justify transhumance (over 400 animals). Those few who engaged in transhumance would, beginning in May, take sheep, goats and cattle to the "high mountains"*(alta montagna)* to graze until October or November (depending on the season's forage production -- *"l'andamento della staggione"*) (Calvello, 78 year old mixed farmer). These large flocks/herds then left the mountain area for winter pastures in the plains-- for the most part, the area of Metaponto and Matera. Traditionally, however, in the environs of Abriola, smaller flocks prevailed. In fact, the bulk of the livestock population remained grazing locally year-round. Typical flock size reached a maximum of 200 head and did not engage in horizontal transhumance. Flock sizes ranged from 2-3 held by landless agricultural labourers, to 10 to 200 for the rest (dependent upon available grazing resources). Common grazing lands existed and exist in the Comune of Abriola. The large part of these common grazing lands are forest at the higher elevations. However, common grazing lands in the form of brush pastures are also present in the valley. This appears to be unique to mountain communities. In Abriola, there were few large land owners (not the large *latifondi* found elsewhere) so the lands remained accessible and the common grazing (*fida pascolo*) well distributed among the small-medium sized herds. At nearby Calvello, however, the *latifondisti* dominated communal grazing lands with their large herds/flocks. They won the lease by out-bidding the small livestock holders who were thereby forced to sublet grazing rights to the common pasture (as in Tolve, see *Fida Pascolo* Appendix B). The wealthy landlords only sublet grazing after first accommodating their own herds, some with 200-300 head cattle in addition to large flocks of ovicaprines, which consumed the vast majority of communal pasture. Those with little land were thus forced to keep few animals which they could maintain using a little hay (spontaneous), tree trimmings, oak and olive leaves, and holly during the winter, and on stubbles (limited by the land available), limited crop grazing, fallow and roadside grazing.

In Basilicata, informants spoke of the loss over the last 30 years of cattle passing through to graze in the common lands -- predominantly oak forests. These herds of largely Podolian breed cattle grazed in open pastures are scarce today, but up to less than 20 years ago their passage to mountain grazing was an annual occurrence. Herds were moved from winter grazing in lowland areas (between November through to May or

June, depending on the season's grazing), to the upland mountain oak forest pastures for the summer period (June to October).

Recent Changes in Agro-pastoralism: Irsina Area Case Study

In describing the changes effected over the last 40 years, a descendant of the landed (baronial) class described the effect of the Land Reform, Common Market subsidies and the industrialization of agriculture on his mixed farm. With reference to the agricultural land reforms, 300 ha of the 1000 ha family property were appropriated from the *latifondo* between 1950-55. These 300 ha were lands already tilled at the location of the actual, old *masseria*. The remaining 700 ha were divided through inheritance.

At the time of the land reform, the only building present at the current location of the *masseria* was located beside the Bradano River and had served to house the hired hands who tended the family cattle herd which was grazed year-round alongside the river. At that time, the river was much deeper and its course not modified by regrading and channelling. An anthropogenic oak forest dominated the vegetation in the vicinity of the river, blackberry bushes and tamarisk predominated along the actual river course. Areas now under cultivation were either oak or *macchia* at the higher elevations. In the informant's father's and grandfather's time, the mixed farm kept *c.* 2000 sheep and 20 goats, and *c.* 400 Podolian-breed cattle. Following the land reform and the relocation of the *masseria* to its current location alongside the Bradano, this area began to be cleared for arable (*dissodato*) between 1953-54, and the cattle were sold. The introduction of state subsidies for wheat in the early 1960's effected another wave of pasture reduction through land clearance (*dissodamento*).

The current flock is composed of *c.* 300 head of sheep (*c.* 70%) and goats (*c.* 30%). Of the 160 odd hectares arable, 109 ha are under wheat which is the maximum allowed under the wheat quota system (*quota grano*). Under later policies, PAC (EEC) established subsidies for lands put under the five-year set-aside fallow. Because the informant keeps sheep and goats, he initially elected the rotational set-aside. However, out of the fear that a small discrepancy in rotated areas (ha) would result in a delayed payment of subsidies, he switched to the 5 year fixed set-aside fallow. Under the Common Market (PAC) agricultural policy, 15% of lands in excess of 60 ha can be put under set-aside fallow. Because the informant's choice is to always cultivate the maximum allowable wheat for the subsidy payments, only 21 ha are currently under set-aside 'bare' fallow.

I asked the proprietor why farmers persist in monocropping wheat despite their understanding of its damaging effects. The informant responded that during the last 10 years the Irsina area has been plagued by droughts (with the exception of last year and probably the current year -- as the season so seemed to indicate). Consequently, all crop production has been poor. Subsidy payments at least allow a margin of profit when wheat prices are low and yields minimal due to droughts.[31]

Another mixed farmer in the same area -- the Bradano River valley below Irsina, also has most of the farm property under cultivation. The lands are fairly accessible (shallow slopes) although they are subject to drought. This informant too observed that there has been a great deal of recent land clearance because of wheat subsidies, concurring that pastures have been further reduced along the Bradano where the river bed has been adjusted and its course redirected and contained. The lands recovered from the Bradano flood plain are almost exclusively arable where before they were rich, untilled pasture. In fact, as far upstream as Oppido Lucano, informants reported that only twenty years ago, the lands along the Bradano and Alvo rivers, for instance, were much more heavily wooded, supporting cattle and pig herds as well as flocks of sheep and goats. Now, with the wheat subsidies, these grazing lands have been turned to sown fields. An additional factor here is the mechanized ploughing which allows single producers to sow and harvest large areas with no additional labour input.

The practise of deep ploughing is considered unsuitable for this drought-prone zone, and has eliminated many species, particularly legumes in cultivated areas, reducing pasture quality (Irsina, *c.* 50 and 55 year old *pastori*). Other informants observed that in the past there were many more annual medicks, clovers, milk vetches and spontaneous *sulla*. These favoured plants are differentially consumed by flocks and their loss is considered to be particularly negative (Irsina, *c.* 55 and 60 year old mixed farmers).

Finally, in the Irsina area, informants also noted that field size has changed dramatically. While the area is largely composed of undulating hills (moraines) rather than steep-sided slopes, and is therefore more "convenient" to plough, it is an area also more subject to drought than the mountainous (cooler and wetter) lands around Cancellara, Vaglio, Abriola, Calvello, for instance. With reference to increased field size, informants noted that this contributed to the number of escaped stubble burns during summer. The larger fields, greater aridity and relatively uninterrupted topography leads to greater threat to olive groves, vineyards, farm buildings, and so on from these escaped fires.

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[31] An Irsina *pastore* argued that the system of subsidies for wheat have ruined animal husbandry as well as soils (Irsina, *c.* 55 year old *pastore*).

Effects of Industrialization

Industrialization coupled with European Common Market legislation have led to a number of alterations in the environment, in agriculture and pastoralism in Basilicata. Set out below, it still remains to be seen whether prolonged pressure to follow EEC policies and adopt increasingly industrial inputs will replace the traditional management strategies and technologies examined here. The thrust of current programs is to draw these local economies into the international market, and to make production more "efficient" and "competitive". In my discussions with plant and animal scientists at both government sponsored university and research institutes, researchers' attitudes reflect those prevalent in the "development" literature, their research goals similarly aim to replace "archaic" varieties of plants and breeds of livestock with more "productive" varieties, to produce standardized products of D.O.C. (*Denominazione di Origine Controllata*) quality for national and international marketing. Livestock husbandry is to focus on stall-fed, intensive production with feed/hay selected for the taste qualities imparted in the milk products, for example (the current thrust of research at the Institute for Zoo-Technological Experimentation -- *Istituto Sperimentale per la Zootecnica, Unitá di Ricerca, Allevamento della Capra,* at Bella of the C.N.R.).

The common thread that runs through the 1950s and 1960s literature particularly, is of the reluctance of "peasants" to adopt modern industrial technologies, often presented as irrational and backward behaviour, born of ignorance. I contend that this is far from the case. Rather, the inventory of traditional tools such as the ard or scratch plough, functions as an integral part of the agro-ecosystem in maintaining relationships between plant and animal communities. The example of the plough is particularly relevant. Its persistence in Cyprus despite external pressure to abandon what is viewed as an archaic instrument (Allen 1989:426) for instance, should be considered in light of the interdependence between cereal cultivation and fallow grazing by sheep and goats.

Industrial agriculture has had a profound impact on soils. First and foremost, according to informants, has been the impact of deep ploughing. Informants universally decried the effects of deep ploughing on the spontaneous flora emergent in the arable. All described a loss of spontaneous legumes, particularly of *Medicago sativa* var. *falcata* (*lu nierv'*), the deep roots of which do not survive deep ploughing whereas before, it was a common constituent of spontaneous growth in the arable. All types of spontaneous plants have disappeared or have been reduced by deep ploughing than were present in the past with the use of wooden ploughs, iron ploughs and animal traction (Oppido Lucano, 83 year old *pastore salariato*/mixed farmer). The traditional ard (scratch plough) ploughed to a depth of *c.* 6-8 cm with the least powerful draught animal, the ass. Oxen were the slowest but most powerful plough animals, ploughing to a depth of *c.* 20 cm. Horses and mules followed ploughed at lesser depths, however, depth of ploughing was also dependent upon the soils being ploughed, and whether or not the land could be ploughed downslope, which increases the depth achieved (Oppido Lucano, 80 year old agricultural labourer).

The valuable annual and perennial spontaneous vegetation was retained and encouraged through the use of the ard which, in lightly scarifying the soils buries annual, self-regenerating legumes at an ideal depth for germination. Deep ploughing, on the other hand, buries the seed too deeply with the result of a dramatic decline in the number of plants available as forage during the fallow rotation. The persistence of any of these plants at all today in the face of deep ploughing is directly attributable to their hardseededness and dormancy. Universally observed by informants is that ploughing at lesser depths than today (with tractors), and the use of manure resulted in a significantly greater abundance of wild clovers and medicks.

Informants in Basilicata refer to the ard plough, the *aratro a chiodo*, as *nostrale*. This term is used with reference to any local product or practise and carries the meaning "of ours" -- native or indigenous. Something designated *nostrale* carries with it the connotation of being of value and superior to imported versions of the same. The term, interestingly enough, is never used in conjunction with the iron plough which tends to still be used today in the communities studied to plough small areas such as inter-cultivated olive and almond groves. The ard is integral to traditional strategies where abundant spontaneous hay in fallow lands provides a valuable, nutritious pasture during the lean period of late summer and early autumn, particularly after stubble burning when only a small amount of precipitation is required to initiate germination and growth. The universal acknowledgment of the loss of valued pasture due to deep ploughing by informants, underscores its past significance.

The ard plough is no longer used -- at least by those interviewed and to their knowledge. Informants pointed out that this plough requires a fair amount of skill on the part of the operator. Many older informants laughingly recounted stories of their experiences as young boys first working this plough. Without the skill and strength necessary to control it, many managed to injure their draught animals as the plough "jumped" out of the soil and perforated the hock rendering the animal lame and the operator subject to much public derision. While ard ploughs are still found in the study area, they are kept out of affection and are likely no longer used because their operation requires more skill than the iron ploughs that initially replaced them, and the tractors and *motozappe* (roto-tillers) that perform more rapidly. Another factor in the abandonment of this tool is the impact of agricultural development workers and the state which encourage through incentive programs the adoption of less labour-intensive, industrial inputs and tools.

Since 1966 or so in the Oppido area, crop rotations have changed because of the widespread introduction of new seed and tools — industrial inputs. The traditional rotation is no longer followed, and has been replaced by an average five or six consecutive years of hard wheat, followed by a fallow year or oats depending upon soil fertility (Oppido Lucano, 65 year old mixed farmer). As discussed previously with reference to economic factors (Chapter 2), market factors and government policies encourage capital-intensive, industrial-style monocropping of wheat. Frequently voiced by informants was the impact of monocropping and the use of herbicides upon the regeneration and variety of weedy grasses and legumes. Noted by informants throughout the communities, the depletion of the spontaneous forage plants in the stubble flora is caused not only by deep ploughing, but also by the application of herbicides (e.g. Oppido Lucano, 58 year old *pastore mezzadro*). The loss of variety of what are typically considered crop infestants, was not viewed as a wholly positive development. For instance, the decrease in the quantity and variety of spontaneous vetch growth in fields was typically pointed out as a negative development, attributed to the herbicides and deep ploughing. More generally, the use of herbicides and chemical fertilizers were universally perceived to be harmful in the long term.

With reference to populations of pests in the arable, Oppido informants acknowledged that in burning stubbles, the insect and snake populations decreased. However, they attribute the general loss of insects to the use of pesticides and herbicides. Before the introduction of these chemicals, informants remember an abundance of grasshoppers and other insects, and a much greater bird population (e.g. Oppido Lucano, *c.* 68 year old mixed farmer, Bradano plain).

Despite intensive monocropping (one case of continuous wheat cropping for 18 consecutive years was reported to me), all informants noted that they eventually returned to the traditional rotation with forage legumes to rejuvenate the soil, even if for a year or two. In fact, for several years, residents of the central study areas managed to avoid monocropping while continuing to claim subsidies for wheat. This was accomplished by sowing other cereals (oats and/or barley), or even mixed cereal and legume forage crops, while claiming wheat subsidies for those fields. This practise ended once inspectors were sent out to ascertain that wheat was, in fact, sown on the claimed land. Another strategy was to claim to have more hectares under cultivation than they had in practise. Again, this strategy was eventually terminated through fiscal controls comparing claims with land registry records. Currently, claims for wheat subsidies have to be substantiated by producing the wheat seed sacks purchased from the local agricultural consortium and the amount of seed purchased has to be consistent with the number of hectares claimed under wheat.

Finally, 40-50 years ago there were many more sheep, goats, cattle and pigs grazing *"allo stato brado"*. Every major *masseria* had three to four hundred sheep/goats/cattle (Oppido Lucano, 86 year old mixed farmer). The larger portions of the terrains were untilled pastures, the example of the Irsina area (above) is representative of the deforestation and tilling of open pastures throughout Basilicata. The clearing of forests in particular is perceived as a negative change, provoking such comments as "[h]ere there is always drought" (*"Qui c'é sempre siccità"*) -- an observation of the changes wrought by the loss of forest pasture to land clearance, particularly over the last two decades (Oppido Lucano, 80 year old agricultural labourer). The loss of forests is commonly considered to be the main cause of increased aridity. The replacement of wood fuel by gas has also permitted deforestation.

Discussion

The changes wrought by industrial tools, inputs, and Common Market subsidies and incentives are consistent across the Basilicata communities. Despite these changes, traditional farming and pastoralism persist in living memory, practise and local knowledge throughout Basilicata. A consistency of practise exists across communities, despite the diversity in elevations and topography.

Timing of sowing and harvesting shifts according to elevation, but the annual cycle of production is consistent across communities. The same applies to crop rotations, differences among which reflect relative property size and production requirements. The fallow is the most variable element in crop rotations, it is a measure of property size (relative wealth), production goals (presence of significant livestock) and elevation. However, although property size impinges upon the use of green manure, the use of sown perennial hay crops, and even annual hay crops, all rotations regardless of location, elevation and property size, involve the use of a leguminous fallow. All engage in manuring their land, whether through the *cortiglia*, or through the application of stall collected manure, and among the least propertied, the use of human waste.

All producers make use of spontaneous hay whether collected from 'bare' fallow or untilled pasture. The central distinction between plains communities and mountain communities emerges in the significance of hay and other sources of fodder. In the plains, stored fodder traditionally was limited and relatively insignificant, particularly where producers had access to forested pasture along the river courses. Now that this pasture has diminished drastically, more emphasis is placed on harvesting spontaneous or cultivated hay. Nevertheless, the importance of these crops in the plains is negligible when compared to the cultivation and collection of fodder in mountain communities.

Across communities, mixed flocks play an instrumental role in farming. Described above and discussed further in following chapters, their role in fertilizing soils, managing spontaneous vegetation as well as the growth of sown crops in the arable is instrumental in improving soils, crops and in mitigating risk.

Chapter 5

PASTURE MANAGEMENT

> The most extensive semi-natural grasslands of the world are extensions of natural grasslands, and are usually produced by the use of fire and grazing animals by man. . . . Their continued existence depends upon grazing, burning . . . most grassland species are well adapted to being grazed and burned. . . . Without this management most agricultural pastures would revert to scrub and eventually to forest (Snaydon 1981:17).

> Anthropogenic fire endowed whole ecosystems, not merely a species (Pyne 1993:250).

> After so many years, so many studies, so many resources expended and skills wasted, we have come to understand that the old systems, despite everything, possess an appreciable potential, that external models are only partially transferable, and that it is best to pursue the course of making the most of indigenous resources (Rubino 1990a:15, my translation).

The flora of the Mediterranean Basin has been the subject of extensive research, particularly from the perspective of fire resilience and the long-term effect of intensive human management (e.g. Blondel and Aronson 1995, Groves 1991, Hobbs et al. 1995, Le Houérou 1981, Naveh 1991a, 1987, 1984, 1982a, 1982c, Naveh and Dan 1973, Naveh and Kuteil 1989, Naveh and Vernet 1991, Noy-Meir and Harpaz 1977-78, Pignatti 1978). Rather than engage in a lengthy review of each of these authors' work, important here are their conclusions: the Mediterranean flora has been shaped by millennia of prescribed burning, cutting, controlled grazing -- in short, it represents a "Total Human Ecosystem" (Naveh 1987:647). Naveh refers to this as a "dynamic flow equilibrium" in which the human manipulation of the environment establishes a "rich, culturally-related landscape mosaic" (1987:646), a landscape with great species heterogeneity that without human management would not be so.

Traditional agro-pastoral management strategies involving grazing, burning and coppicing produces significantly more productive environments (Naveh 1987:646). Prescribed burning of the Mediterranean flora creates an open and species-rich community which is significantly less susceptible to destructive fires than were it left unmanaged (Naveh 1982c:21). "Mediterranean land use and its impact on the landscape can be described as being cycles of multivariate anthropogenic biofunctions, corresponding to the main phases of changing land use" (Naveh 1982a:21). The Mediterranean then, has an extensive and ancient history of intensive land use and can be considered as a human induced environment (Duhme and Hinckley 1982:581).

The data pertaining to the management of pastures and herding strategies described in the foregoing chapter are explored here with reference to technical reports and parallel practises elsewhere. The data are analysed according to pasture resources and their management by cutting, burning and grazing. The final section of this chapter is dedicated to a discussion of the data as they bear on stocking rates.

Management of Untilled Lands: *Saltus and Silva*[1]

Lands characterized by a topography which inhibits arable cultivation such as extreme slopes and rocky terrains, or cultivated as arable in the past but since abandoned, and lands along seasonal streams and rivers are defined here as untilled areas.[2] Included also are those lands set aside for common grazing which may or may not be suited to plough or hoe cultivation (arable). Vegetation on untilled lands in south Italy is characteristically *macchia* or *gariga*.[3] The categories set out by Kunholtz-Lordat (1964:207-213), distinguishing *ager* (tilled, arable fields) from *saltus* (fallow, untilled pastures and grasslands) and *silva* (shrublands and forests), follow the Classical tradition of classifying the landscape into use-categories (see Podimatas 1990:64-66 for similar divisions of the Greek landscape). Except the inclusion of fallow land in the *saltus* (which informants view as *ager* lands), these divisions are conceptually the same as those used by informants[4] and are therefore relevant to the following discussion.

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[1] My research in this sphere and interpretation of the results builds upon the previous research of Dr. H.T. Lewis in South Australia. His study (Lewis and Boag n.d.) investigates the use of fire and grazing by Australian farmers and shepherds. The technologies he describes strikingly parallel strategies undertaken by Basilicata *pastori* and farmers.

[2] 'Arable' and 'cultivation' are both used here to emphasize that plough or tillage cultivation (arable) is one form, whereas "cultivation" is understood to include plant propagation and management technologies such as prescribed burning and controlled grazing. The distinction is not always valid, however. In fallow arable lands, for example, these tend to be both tilled (ploughed) and cultivated through the use of fire and grazing animals (see also Edelsward 1994:27).

[3] *Gariga* is defined as "A low, open scrubland, restricted to limestone sites in the Mediterranean area; characterized by small evergreen shrubs and low trees" (Zanichelli 1986:618) whereas, *macchia* is "A type of vegetation composed of shrubs, or scrub, not usually exceeding 3 meters in height, the majority having small, hard, leathery, often spiny or needlelike drought-resistant leaves and occurring in areas with a Mediterranean climate" (ibid.:910; see also Pignatti 1978:180).

The mosaic of anthropogenic environments is composed of interspersed tilled *(ager)* and untilled *(saltus* and *silva)* areas. Untilled zones are dispersed throughout the landscape, across the dissected topography and variations in altitude characteristic of the southern Apennines. Differences in location on the vertical gradient, exposure, and location *vis-a-vis* the paths of prevailing winds (see Croce 1930:34), all contribute to a high degree of micro-environmental zonation. Altitude, topography, exposure (aspect) and soils create diverse microclimates, contributing to variations in the species composition of plant communities and importantly, to staggered plant maturation (Evans and Young 1989; Narjisse et al. 1991:225; Forbes 1982:283, 326, 330).

Variation in altitude is particularly important because plants mature differentially from valley to hill and mountaintop, and also according to aspect. Temperature and moisture vary with altitude such that higher elevations are cooler and wetter (see also Isbell 1978:23 for parallel variations in the Andes). This diversity of micro-environments protects against complete losses of grazing resources across zones. The proximity of valley to mountain allows *pastori* to move their flocks across diverse plant communities at variable growth stages during the course of a single day's grazing.

Daily routes vary depending upon the seasonal grazing resources and on the location of the sheep/goat fold. In the majority of cases, folds (sheep and goat) are located in ecotones, mid-slope between arable lands (below) and forest/*macchia* (above) for ready access to the range of micro-environmental zones and water (see also Koster 1977:178 for a parallel strategy in Greece; Hole 1978:164-165). A day's grazing always entails the movement of flocks from folds, either up-slope initially or down-slope during which the flocks are always moving as they graze. The speed at which a flock moves depends in part upon ambient temperature and therefore varies with season and over the course of the day (cool temperatures allow the flock to move rapidly, heat slows the animals), and upon the forage available -- its density and quality. Importantly, while grazing, the flocks are never stationary, and *pastori* always keep them on the move through grazing so that only a limited amount of available forage is consumed in any single area in the course of the day's grazing (see Noy-Meir and Seligman 1979:130-131 for parallel strategies in Israel). The duration animals graze in any one area is at the *pastore*'s discretion, although the flocks tend not to linger in forage-poor areas. Discussed below with reference to tilled areas, *pastori* will keep animals grazing longer in fields at particular times of the year.

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[4] *Saldone* is the term used by informants for *saltus* and *bosco* (forest) for *silva*.

Grazing times vary according to season. During winter, Basilicata *pastori* avoid taking their flocks out in the early morning when it is too humid, preferring also to provide them with straw or hay to curb their hunger so that they do not consume excessively at the start of their grazing, practises which experimentally have been shown to enhance digestion of forage and curb bloat problems (e.g. Verità and Cianci 1992:95). A rest period for flock, dogs[5] and *pastore* is planned at midday when flocks are led to water and there ruminate for approximately an hour in summer, less in winter. A parallel Greek example:

> After being grazed through the morning, the herders will lead their flocks to the . . . resting area, where in the midday heat the goats will rest and ruminate for an hour or so. Often the [rest area] will be an area near a water source which allows the goats to quench their thirst. This water will also stimulate further grazing in the afternoon (Koster 1977:206).

Vertical Mobility and Resources

> Herds located at lower altitudes do not move as much . . . but use different grazing areas around a relatively fixed site (evergreen oak woodland, low shrubland, stubble). [. . . . .]
>
> Gradients of altitude, exposure, soil types, even the history of plant formations thus contribute to provide diversified resources at different periods of the year (Narjisse et al. 1991:231).

Often overlooked by those interested in seasonal, horizontal transhumance,[6] altitude variability extends the availability and diversity of grazing resources along the vertical gradient, providing the forage necessary for localized maintenance of flocks by

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[5] In Basilicata and Apulia, dogs accompany flocks for protection and not for herding. The same holds true for South Greece (Koster 1977:200).

[6] By this I mean summer and winter pastures with the movement of large flocks across significant distances from one to the other. This form of long-distance horizontal transhumance applies where the number of animals in a flock/herd exceeds available forage during the period of minimum pasture production. This I contrast with the grazing of flocks year-round in the vicinity of the farm/sheepfold (*jazzo*), on average, within a radius of 2 km.

pastori.[7] *Pastori* access diverse grazing resources for their flocks throughout the year across the vertical gradient. An important factor in extending pasture availability, plant development is staggered across the vertical gradient. In broad terms, maturing cereals are protected from grazing for approximately three months during the development of the grain head. However, stubbles from harvested cereals are available for grazing in the low-lying plains 15 to 30 days before fields of the same variety grain at higher elevations are harvested. Crops (and vegetation generally), at the same altitude will mature a week or two later on a northern exposure than will the same crop, sown later, grown on a slope with a southern exposure. In practise, the periods during which areas are protected from grazing are staggered across the landscape and altitudinal gradient. In the study area, the protection of cereals from grazing amounts to approximately 10 weeks in the year across the range of vegetation zones.[8] In yet more general terms, plant communities situated on north-facing pastures at higher elevations continue to produce fresh growth while south-facing slopes at the same or lower elevations provide mature, seeding forage plants. Controlled burning in late winter - early spring is also said by *pastori* to extend the availability of green growth by at least a week or two (see also Le Houérou 1981:490). All of these factors contribute to the maintenance of versatile, stable, year-round grazing, and reduce the impact and duration of dry-season, low forage availability.

A distinction must be made between slash and burn type cultivation (*debbio*) and the burning of pastures, forest understorey, fallow and stubbles (*cinefazzione*). Both are ancient technologies, and both apply to the Italian South. Slash and burn cultivation is described by Sereni (1981), and is not discussed further in this study because it is not practised by the research subjects. The practise of *cinefazzione*, defined by di Bérenger (1965:372) consists of controlled burning only of the herbaceous mat, twigs, leaves, and so on, covering the soil to stimulate growth and increase soil fertility.[9] The practise also helps to 'open' the soil, making it more permeable to moisture (ibid.:373). It is this practise which is described below.

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[7] See Verità and Cianci (1992:88) for reference to the seasonality of pasture production mitigated by vertical daily movements of flocks.

[8] In the central research area, pressure on grazing resources at the time of research was low and most wheat farmers did not have their wheat grazed, although stubbles and fallow are still commonly grazed by ovicaprid flocks. That wheat growth is no longer commonly grazed, what *pastori* refer to as "holding back/maintaining" the wheat, is also in large measure due to the new varieties of wheat which have been selected for their short stems. Traditional varieties tended to grow tall and hence benefited significantly from grazing which induced tillering and mitigated against lodging.

Cutting, burning and grazing the *saltus* and *silva*

> Most of the world's grasslands and semi-arid woodlands would be colonized by shrubs and provide very little grazing were it not for the influence of fire (Harrington 1981:196).
>
> The use of fire is a skill of the *pastore* and the small farmer (Angioni 1989:25, my translation).
>
> It has been for centuries that *pastori* and small farmers have been engaged in burning fields and forests to improve pastures and harvests (Angioni 1989:232, my translation).
>
> *Per pulire, si bruciava* (we burned to clean) -- Cancellara *pastore*.

Untilled grazing areas *(saltus* and *silva)* are used as pasture year-round. With reference to the *saltus*, informants describe pastures actively in use as "clean,"[10] emphasizing the role of grazing animals in maintaining this state. *Pastori* themselves actively shape these plant communities by selectively cutting and burning those plants which are deemed to have no economic value or are harmful to their flocks (e.g. *Xanthium* sp., the fruits of which are spiny, tangling easily in the hair of sheep and goats, and doing significant damage to the udder when they lodge between hind legs and udder) (see also Meloni 1984:123; Liacos 1973:74 for Greek parallels). Plants such as the fire stimulated brambles (*Rubus fruticosus*) which occur in both *saltus* and *silva*, are the bane of *pastori* as they inhibit the free passage of their sheep. Goats in the flock help to curtail the spread of these plants by consuming fresh growth. *Pastori* however, must cut back and burn old growth which is unpalatable to goats. In order to set back growth as much as possible, *pastori* occasionally will add extra fuel such as bits of dried wood collected from nearby to insure a more lasting, thorough burn.

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[9] Di Bérenger (1965:372-373) distinguishes *addebbiamento* (*debbio)* from *cinefazzione* on the basis of depth of burn -- whether the burn enters the soil or not, a distinction which he uses to separate the cleaning of pastures (*cinefazzione*) from the burning of stubbles, and with which I do not concur.

[10] The use of the terms "clean" and "dirty" are used to describe "managed" and "abandoned" areas respectively. This cultural aesthetic perception of the environment, intimately tied to productive value, underscores the significance of human management in maintaining the Mediterranean cultural landscape. Of Sardinia, Edelsward writes:

> The land was not, of course, wilderness in the sense of being untouched, because the contemporary geography of the island, and in particular its vegetation (deforested *macchia*) are the product of millennia of interactions between the environment and its inhabitants. It is also named, intimately known and regularly used by *pastori* (Edelsward 1994:727).

This same negative characteristic of thorny plants' impeding access to browsers and grazers however, is used by *pastori* in their management practises under other circumstances. For example, bramble bushes are left where the *pastore* decides to let a favoured plant grow such as a seedling tree selected to replace one nearby that shall be cut, or to protect the growth of a wild pear seedling.[11] Burning individual plants is also undertaken to encourage fresh, more tender and palatable growth in the pyrophyllic plants that dominate these pastures (see also Menke 1989:185; Bell 1985/86; Liacos 1973:93). Among these are the Spanish broom (*Spartium junceum*) and cultivated and wild cane *(Arundineae: Arundo donax* and *Phragmites communis)* which are sought out by both sheep and goats. Wild asparagus bushes *(Asparagus acutifolius)* are also regularly burned in these areas to encourage fresh growth. These are harvested by the *pastori* who burn them, and the tender shoots are also grazed by flocks. Both fire and grazing serve to maintain pasture productivity and a suitable grazing environment. Controlled burning to promote pasture regeneration and maintenance is a broadly applied management strategy, particularly in semi-arid zones.

> The controlled use of fire is another grazing management strategy, traditionally used in Pokot [Kenya/Uganda] and other pastoral societies, but fiercely fought by institutional agencies. The Pokot claim that fire results in the relative increase of grass and decrease of bush . . . Also bush fires result in the burning of dry impalatable grasses and inedible acacia seedlings, in killing insect pests, in releasing nutrients more quickly than natural processes do and in encouraging fresh edible shoots (Dietz 1987:124).

Similarly, with reference to the pasture management technology used by the Gabra nomads who herd goats and cattle (eastern Africa), Maybury-Lewis (1997) writes:

> They manage their pastures by setting controlled fires to drive back the bush. Because their herds soon denude an area of edible grasses, leaving only unpalatable ones, Gabra burn off the bad grasses to allow the good ones to flourish in the ash (Maybury-Lewis 1997:34).

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[11] The management practise of encouraging the growth of wild fruit trees such as wild pears (*Pyrus communis,* also fire - tolerant), also involves pruning and grafting domestic varieties, even where the trees occur in common grazing lands. They are also frequently left *'au naturel'* for their fruits which are readily consumed by sheep and goats.

Whereas British colonial policy forbad the continued use of controlled burning in this area, the subsequent buildup of fuels led to uncontrolled, damaging fires.

> Nowadays, Kenyan ranchers are using the Gabra combination of camel browsing and range firing to keep the grass lands under control (Maybury-Lewis 1997:35).

Selection of valued forage plants through controlled burning of pasture was reported by all *pastori*. Valued forage is generally composed of legumes and grasses:

> Adventitious plant species include most of those exploited in animal feeding and are included in mostly in the Graminae and the Leguminosae. Other plants produce toxic substances when they are stressed, thereby protecting themselves against grazing . . . (Van Soest 1988:75).

As their flocks grazed, Basilicata *pastori* pointed out to me particular plants to be fire encouraged excellent forage. Among these, I identified *Scorpiurus muricatus, Lotus corniculatus, Trifolium stellatum, T. arvense, T. repens, T. augustifolium, Hedysarum* spp., *Onobrychis* spp., *Medicago lupulina, M. polymorpha,*[12] *M. orbicularis, M. sativa* var. *falcata* and, *Vicia* spp. *Pastori* identified in pastures, *Scorpiurus muricatus* and *Lotus corniculatus* as particularly responsive to burning, appearing in abundance following fire, and as excellent forage consumed voraciously by their animals. A study of pastures in central Italy makes special note of the initial post-fire abundance of *Scorpiurus muricatus*, which had decreased sharply in prevalence four years following the burn (de Lillis and Testi 1990:61). *Pastori* were unanimous in asserting that controlled fires stimulate the germination of fresh, high quality forage not only of herbaceous plants, but also of shrubs.[13] These observations are supported by research undertaken in the Apulian *macchia* documenting changes from a dense scrub to an annual species-rich pasture of *Trifolium stellatum*, *T. augustifolium, Medicago minima, Aegilops ovata*,[14] *Avena sterilis, Bromus erectus, B. sterilis,* and *Dactylis glomerata* (Bianco 1958:392-394, 1960:331-332; see also Arianoutsou and Margaris 1981:187; Liacos 1973:88), all of which have dormant seeds responsive to fire by germinating (Groves 1986:135), whereas such valuable forage plants are scarce in mature (unmanaged) ecosystems (Arianoutsou and Margaris 1981:184).

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[12] *Medicago polymorpha* L. and *M. minima* (L.) Bart., are especially dominant constituents of pastures, and are considered to be among the " . . . most aggressively colonising species . . ." (Brockwell 1985:39).

[13] Shrubs regenerating after a burn by sending out new shoots from above-ground, extant branches (phanerophytes) include *Spartium junceum* and *Rubus fruticosus*.

[14] Unlike many other 'wild' grasses, *Aegilops* sp. thrives under conditions of heavy grazing (Noy-Meir 1990:303; Noy-Meir et al. 1991b:382).

Furthermore, the elimination of vegetation by fire, *pastori* asserted, is essential because the lack of precipitation establishes conditions under which litter decomposes only slowly. Dead vegetation blocks seeds from reaching the soil surface and impedes germinated seedling growth. *Pastori* also asserted that burning in the *saltus* softens the soil, making the surface more permeable to germinating seeds. A number of *pastori* acknowledged that sheep and goats do consume dry grasses in spring, but all asserted that the flocks thrive on the pastures that had been winter burned and hence produced fresh growth in spring. Discussed further below with reference to stubbles, in arid and semi-arid areas fire is a necessary tool for eliminating this thatch, and to hasten the decomposition of plant material (Jones 1987:20).

A characteristic bush of the Mediterranean macchia, *Cistus monspeliensis'* (Cistaceae: rockrose family) was harvested for kindling. This harvesting strictly controlled its distribution (Iannelli 1989:78). Because it is no longer generally used, it has become a dominant component in many pastures (similar to the problems with *Crataegus monogyna*) and is thus viewed as a weed despite its being favoured by goats (Perevolotsky 1989:1079). A study of Sardinian pasture management of this species through mechanical removal compared those results with the effect of fire on adjacent pasture (Basso et al. 1992a, 1992b).[15] *Cistus* was not eliminated, but was drastically reduced in the burned areas (mechanical clearance nearly eliminated the species)[16] while the burn also served to improve pasture:

> The data . . . reveals a consistent increase in *Leguminosae* rising from an initial 25% to 70% following the fire, and registering values of 60 and 50% for the other two years. The Gramineae on the other hand, fall from 50% before the fire to

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[15] Sardinia has an ancient history of fire technology -- particularly prescribed burning of pastures by *pastori* (Le Lannou 1941; Angioni 1989:231-239). I submit that the burned pasture studied by Basso et al. (1992a), had probably been burnt by *pastori*.

[16] The maintenance of some shrubs is important in that it helps to reduce erosion (e.g. Bintliff 1994:136; Rackham 1983). Furthermore, in semi-arid and arid zone, bushes create micro-environments less subject to evapo-transpiration and that trap soil moisture (e.g. Khalik et al. 1992:135-136). *Pastori* similarly do not remove stones/rocks from pastures because they tend to trap moisture, creating a micro-environment that extends the growth of forage plants in their vicinity (see Pagnotta et al. 1990:122 for the same practise by Syrian *pastori*; Noy-Meir et al. 1991a:386,394; 1991b:380 for experimental results showing rocks to modify micro-environments in pastures, increased soil moisture and precocious germination).

> 15% after, rising to 20 and 35% in the remaining two years. . . . . The results of fire however, markedly favours the development of *Leguminosae* (in particular *Trifolium subterraneum*) which, beyond increasing the protein content of pasture forage, increases its palatability (Basso et al. 1992a:356-57, my translation).

The burn to control *Cistus* dominance in pasture clearly has a more general, positive effect on pasture quality than merely a reduction of the 'target' bush species. Characterized as a competitive, drought resistant, pyrophyllic species, *Cistus monspeliensis* responds to the temperature effects of fire in the same way as legumes, that is, by a reduction in seed coat hardness which enhances germination (Iannelli 1989:78; Arianoutsou-Faraggitaki and Margaris 1981:181; Keeley 1995:248-249; Trabaud 1987:609).[17] Another study demonstrated that frequent burning (every second year) would eliminate this species (Trabaud 1991:183; see also Mazzoleni and Pizzolongo 1990:44-46). Consequently, its persistence suggests that it is a desired pasture component (see footnote 17 below), which like other highly successful *macchia* vegetation, has colonized environments managed by controlled grazing and prescribed burning, and is maintained by these same technologies.

Pastori detailed for me the suitable conditions for burning, the primary condition being a dry ground surface. A good burn is described as a slow, calm burn, but one that is always moving forward, not lingering in one place. Another condition required for a good burn is a little wind, it being the *voria* which is cool, brisk and comes from the north-east. The wind should carry the fire along the ground, little by little.[18] *"Si brucia solo con il vento l'inverno – un vento al contraio per pulire l'ambiente"* ("During the winter, one burns only when there is wind – an opposing wind to clean the environment", Tolve 45 year old *pastore*). Whether burning during winter or summer, informants emphasized that under conditions of dry grasses, fires are set so that they burn against the wind. That is, under dry conditions fires are set using the wind as a brake such that the fire is not carried into areas which they do not want to burn. Fires should be set under conditions that remove accumulated dry, unpalatable growth, but do not linger, and burn down into the soil surface (*cinefazzione*). This is true especially of the hotter fires of August at which time burns are preferentially set at night or in the early morning (see also Jones 1987:77 for ideal burning conditions). Managing burns to avoid penetrating the soil surface itself, insures seed survival (see Menke 1989:179). These are controlled burns, in which small areas are burnt at a time. The mosaic of burned and unburned areas act as fire breaks (see also Harrington 1981:197-198). Burning of large areas is not undertaken typically, because such fires become difficult to control and readily get out of hand. Parallel burning conditions and practises[19] are undertaken in New South Wales, Australia:

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[17] *Cistus monspeliensis* is an obligate re-seeder (Arianoutsou-Faraggitaki and Margaris 1981:182; Trabaud 1987:617). In other words, in order to reproduce this plant is reliant upon fire for seed germination (ibid.).

[18] See Pratt and Gwynne (1977: 132-133) for comparable practises in rangeland management in East Africa, and Omer Stewart (1956:120-123) for an overview of burning.

> A fire's intensity and rate of speed is related to air temperature, humidity, and wind speed. [. . . .]
>
> In the semi-arid woodlands, a wind speed of 7-10 km per hour is ideal to carry a fire, allowing flame from one tussock to set fire to its neighbour. [. . . .]
>
> Mosaic burning, where perhaps 30% of a property is burnt, is recommended, rather than burning vast areas at one time. This aids fire control, leaves fodder for stock, and promotes ecological diversity (Bell 1985/86:6).

In the South Italian instance, care is taken to avoid burns spreading into ever-present olive groves, vineyards and cultivated fields which are interspersed throughout the landscape are easily fire-damaged.

Burns to clean dense vegetation are generally undertaken in late winter and sometimes in early spring before the onset of spring growth. Their timing depends on precipitation over the winter and hence, the status of plant growth.[20] All informants (forestry officials, *pastori*, farmers, agricultural workers, and so on) commented that pre-1950 when the area was well-stocked with animals, untended ('dirty'), impenetrable areas did not exist. This was due to not only browsing by the animals, but also to the greater demand for firewood and kindling as fuel. It is only during the last two decades that household use of fossil fuels has become commonplace, thus diminishing the demand for wood fuel.

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[19] Other examples of controlled, prescribed burning: Anderson and Bailey (1980) for Alberta, Canada grasslands burning; Lewis (1977, 1980, 1982, 1985, 1991b, 1993; Lewis and Ferguson 1988) for similar strategies of traditional burning in Alberta and California; Scott (1977) for mediterranean-climate traditional Peruvian burning of savanna; and Minnich (1983) for California.

[20] Vázquez and Moreno (1993) investigated the correlation of fires with meteorological variables in Mediterranean and Atlantic Spain. They found that prescribed burns for pastures (across landscape types) were poorly correlated to hot, dry weather, whereas arsonist and accidental fires were significantly correlated to meteorological variables. Their conclusions are consonant with the timing of prescribed pasture and woodland burns in Basilicata, only a small proportion of which occur at the height of heat (daytime) and drought.

Other more generalized burns of grazing areas are regularly undertaken by the *pastori* interviewed. These occur most often during the summer. The celebration of San Rocco in the Catholic calendar (16 August) marks the beginning of the legal summer burning period for stubbles, and most *pastori* concentrate their burning of pastures to remove old growth after this date, to clean the soil surface (*"Il fuoco pulisce la terra"*). By eliminating the old growth that forms a mat covering the soil surface, seeds are able to fall to the soil surface and germinated seedlings are not impeded in their growth by extant residues (see also Webber et al. 1976:35). For more extensive burns, only half the available pasture is burned at once so that flocks always have something to eat. If rains follow the initial burns, and there is sufficient new growth in the burnt half, then the remaining half is burned towards the end of September, cleaning the whole area and generating fresh growth for winter grazing. A large portion of valued forage plants in the area possess the adaptive advantage of fire-triggered rapid germination[21] (Young and Evans 1989:42). Liacos (1973:74) reports that Greek herders use fire to stimulate growth of green forage from dormant seed in late summer when all other vegetation is dry, although the forage produced from these burns is limited. While Basilicatan *pastori* recognize this characteristic, in this dry area, they stipulate that a good rain is necessary for decent initial growth. Therefore, if there is insufficient late summer - early fall precipitation to produce plentiful fresh growth in the areas burned in August, then *pastori* wait until mid-January to the end of February to burn remaining areas.

> In southern Italy, goat farming . . . production systems are based upon the optimal use of pastures, i.e. favouring the intake of grass without compromising milk production. The utilization of pastures must be continuous, but it is important to reserve a part of the grazing area (40 to 60%) for the production of good quality hay in the spring (Masson et al. 1991:156).

In Basilicata, winter burns are set in anticipation of usually predictable March and

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[21] A roadside burn without a drop of precipitation produced an abundance of germinating legumes (primarily vetches, clovers, yellow vetchling (*Lathyrus aphaca*) and grasses). The stimulated germination by fire may also be related to the exposure of the soil which absorbs more heat and promotes growth (Jones 1987:70).

April rains. The combination of fire and rain generates lush, fresh growth.[22] The burns serve to "clean" pastures.[23] However, *pastori* are careful to maintain sufficient unburned pasture reserves because precipitation to initiate fresh growth cannot be relied upon. The maintenance of grazing reserves is universal among *pastori*. All *pastori* and other individuals who maintain stall-fed animals identify excellent quality spontaneous forage (also from fallow lands) which they set aside (defer grazing) for later harvesting as hay (see also Harrington 1981:196).[24]

Frequency of pasture burning depends on the condition of pasture vegetation. Detailed below, in areas with low stocking rates, burns are more frequent, perhaps every third year. Intensively grazed pastures are not likely to be burned until less palatable flora (controlled in an on-going fashion through spot-burning) begins to dominate. Lewthwaite (1984:28) documents similar management practises among Corsican herders, stressing that burning is an adjunct to extensive grazing systems where 'surplus' growth is not consumed and maintenance of pastures requires that they be burned.[25] With the decreased number of animals throughout the area (see below) and the inability of limited numbers of animals to keep up with the plant growth, it follows that burning frequency should have increased. However, field observations and informant interviews indicate that large portions of untilled pasture are abandoned and recolonised as pasture after intervals of up to ten years, first by burning and then by reintroducing animals (see also Wilson 1982:327 for Australian examples). As a result, a shifting mosaic of active and abandoned pasture is now characteristic of the Basilicata landscape. The recolonization of environments using fire in the south Italian example parallels Lewis' (1992, 1994) distinction between corrective burns and management burns by Australian Aborigines.[26] A useful tool for conceptualizing human-maintained landscapes diachronically "[c]orrective fires are the first and most dramatic step in the renewal and restoration of habitats to conditions which are more easily and effectively managed" (Lewis 1992:23). The exodus of rural populations in Sardegna has resulted problems parallelling those in Basilicata.

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[22] Improved pasture composition following burning has been demonstrated in experimental trials measuring weight gain in ewes and lambs (Menke 1989:179).

[23] Pasture burning appears in texts as a management tool to be abandoned in favour of mechanical clearance by cutting or haying (e.g. Iannelli 1989:65; see also Basso et al. 1992, above). However, controlled winter burning of pastures for improved forage is a suggested management tool in Greece (Meuret et al. 1991:167-168), Israel (Naveh 1991:554) and in Kenya (Dietz 1987:168).

[24] The composition of these varied among the samples I examined. They include always, spontaneous legumes (one or more of the following: *Vicia* spp., *Trifolium* spp., *Medicago* spp., *Lathyrus* spp.) and grasses (particularly *Phalaris* spp., *Avena* sp., *Lolium* sp., *Myosotis* sp.), and forbs such as *Papaver* sp., *Fumaria* sp., and *Sinapis* sp..

[25] See also Métaillié (1978) for similar patterns of burning under extensive herding in the French Pyrénées and for parallel problems in under-stocked and abandoned pastures (also Gintzburger et al. 1990:183 for S.E. France). The flip side is a proscription on burning, because there is no need to "clean" pastures, where stocking rates are high.

> The disappearance of human management in the territory is accompanied after only a brief interval, by the extension of the mediterranean *macchia*, in particular, by *Cistus*, lands not cleaned annually become full of thistle and brambles. «The formation of grasslands are foreign to the climate of central Sardinia and can only be maintained through fire or with the plough; bare pasture left to its own devices inexorably reverts to shrubs and secondary *macchia*»[27] . . . . [Fire] becomes the only means to reopen to grazing spaces which the mediterranean *macchia* constantly tends to diminish" (Meloni 1984:123).

Untended pasture areas constitute more than dangerous accumulations of fuel (Veronesi et al. 1990:129; Lorenzoni 1987:88). Their abandonment, even for a year, renders them impenetrable to sheep and eventually chokes-off access even to goats (see for example Bianco 1960:332).[28] Where this occurs, controlled spot burning is ineffectual and *pastori* undertake more extensive, corrective burns. Because of longstanding legislation prohibiting the use of fire in these areas, *pastori* employ such tactics as igniting a pat of dried cattle dung which burns slowly and allows them the time necessary to distance themselves and their flock from the site before fire ignites the vegetation (Vasalvo, forestry marshal, personal communication). These burns are acknowledged to occur regularly and the identities of the *pastori* undertaking the burns are suspected or known. Nevertheless, the law is rarely enforced because the value of these burns is recognized in reducing accumulations of dry, dense, pyrophyllic plants that, if left untended, can fuel large scale, extremely disruptive and dangerous fires during the arid summer months (Basso 1991:109; Veronesi et al. 1990:129; Lorenzoni 1987:88; Meloni 1984:123).

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[26] Fire intensity is dependent upon frequency of prescribed burns and consequently, the composition of the vegetation (Westman et al. 1981:172).

[27] G. Barberis, *La difesa antincendio del patrimonio della Sardegna*, Ispettorato dipartimento foreste, Nuoro, 1981.

[28] Bianco's (1960) study of post-fire plant succession in Puglia revealed that the richest herbaceous growth occurred in the earliest stages following a burn. Arianoutsou-Faraggitaki and Margaris (1981) also documented the burgeoning of valuable forage plants following a fire while indicating their scarcity in mature ecosystems which had not been burned for a number of years (1981:184, 187).

Pastori engage in controlled burning to maintain pasture productivity in a number of ways and for a number of reasons. "Spot burns" are used to eliminate undesirable plant species; "cooler" controlled burns act to set back growth in mature vegetation and initiate fresh growth from old plants; more extensive, corrective burns open up areas to animals and remove old, less palatable growth[29] and also "clean" the herbaceous layers prompting the fresh growth of grasses, legumes and other forbs (see also Menke 1989:178-180).[30] As discussed above, fire further acts to promote the germination of valuable forage plants, particularly the annual, hardseeded legumes.[31] At the same time, the amount of accumulated dry matter is controlled, reducing the probability of hotter and often destructive summer fires which usually result from escaped stubble burns.

Sheep and goats as tools

> While livestock keepers have no control over climate, they are able to influence primary and secondary productivity by their choice of animal species, the number, sex and age composition of the herds, and the distribution of animals spatially and temporally across their specific grazing area (Hocking et al. 1992:715).
>
> The nature of the subsoil, layout of the stratigraphy, configuration of the topographic relief, and pH of the arable soils, combine to design this amazingly complex mosaic of which the shepherd, better than the scholar, has an intimate and profound understanding (Le Lannou 1941:51-52, my translation).
>
> The disappearance of animal husbandry compromises ecological stability (Galante and Sala 1987:36, my translation).

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[29] See also Bell (1985/86:4) for increase in unpalatable plants due to lack of burning in Australian pastures.

[30] *Pastori* also maintain that burning in these untilled areas reduces the number of disease-bearing insects and parasites such as ticks which are harmful to their flocks (see also Le Lannou 1941:187; Conant 1982:121 for similar practises among the Pokot, East Africa). Fire has also been shown to reduce plant pests such as aphids (Hardison 1976:364-367).

[31] E.g. annual medics, vetches, *Hedysarum* sp., *Onobrychis* sp., *Coronilla* sp.,*Scorpiurius* sp., *Lotus* sp., *Lathyrus* sp., *Astralagus* sp. and clovers (see also Groves 1986:135).

In untilled areas, *pastori* use not only fire, but also their flocks to maintain pasture productivity. *Pastori*'s intimate understanding of the complexities of plant-animal-soil interactions is manifest in the use of their flocks as tools. Fire is either used alone or in combination with ovicaprids: both are tools essential to maintaining pasture productivity.

The use of flocks as tools for managing pasture plant composition is more complex than appears at first glance. *Pastori* in the study area argued that the grazing of pastures both significantly reduces the accumulation of dry plant matter which becomes a fire-hazard in unmanaged environments, and precipitates pasture plant growth (see also Acutis and Costa 1993:61, 64; Lucifero 1984:34; Brogi 1984:37). Like fire, grazing is perceived to enhance forage plants. This perception by *pastori* interviewed is supported by many studies documenting the effect on pasture plants by grazers (see also Lidicker 1989:135).

Pastori argue that the presence of good forage depends on grazing. Their observations are supported by studies monitoring changing species composition of grazed as opposed to abandoned pastures (e.g. Noy-Meir et al. 1989; Fox and Fox 1986:52). "The main effect of grazers on grasslands is the removal of living parts, which is selective and hence differential between species" (Noy-Meir et al. 1989:291; see also Pollard 1992:222; Quinn 1986). Moreover, "[m]embers of more tolerant plant species become more common in communities as a result of grazing on that community" (Pollard 1992:220; see also Hoveland 1989). Some such changes include the increase in particular annual and perennial grass species (e.g. *Aegilops* sp., *Hordeum spontaneum, Avena sterilis, Triticum* sp., *Lolium* sp., *Dactylis glomerata, Phalaris* sp.) and leguminous forage species (e.g. *Hedysarum, Trifolium, Vicia*) all of which appear to be favoured by both grazing and burning (e.g. Menke 1989:178). Both the composition and ecotypes (plant species morphological and physiological differences attributed to environment -- soils, climate, precipitation, grazing regime, etc.) of pasture flora reflect the established grazing regime (Noy-Meir et al. 1989:305-306; Pollard 1992:219).

> In one grazing day, goats are capable of travelling more than 4 km and climbing more than 800 m in altitude. They thus encounter a heterogenous vegetation, with variations occurring even within the same species. By selecting their diet, goats affect the growth dynamics and the subsequent value of forage species (Meuret et al. 1991:161).

Forage plant maturation varies seasonally, and consequently, so do plant forage values (see also Le Lannou 1941:52; Pazzi et al. 1990; Bonciarelli et al. 1990; Santilocchi and Bonciarelli 1990; Pardini et al. 1990). This adds another dimension to the great heterogeneity of environments and the management of the forage plant communities. Prescribed burning stimulates production of valued forage by encouraging shoot growth and seed germination and conversely eliminates those plants of limited or no forage value.

Grazing influences more than the growth form of a plant. It opens up the sward (Noy-Meir et al. 1989:290, 305-307; Noy-Meir 1992:14;1990:301; Milton 1994; Wilson 1981:268).[32] In so doing, grazers reduce the foliage cover which increases light penetration to lower-growing species such as legumes (Curll and Jones 1989:347; see also Mazzoleni and Pizzolongo 1990:48-49; Noy-Meir 1990:301; Frame and Newbould 1984:26-27; Webber et al. 1976:35 for the Australian mechanized version referred to as "topping"; Tilman and Pacala 1993:21 for plant height and competitive advantage).

> Several researchers studying mediterranean annual-plant dominated grasslands have shown that exclusion of or light livestock grazing during the growing season quickly leads to grass dominance, especially in ripgut brome (*Bromus diandrus*) and slender wild oat (*Avena barbata*), with associated loss of nutritious legumes, notably clovers (*Trifolium* spp.), medics (*Medicago* spp.), and filarees (*Erodium* spp.) (Menke 1989:190).

The response of cereals and legumes to grazing by tillering is important in the evolutionary history of these plants under the selective pressure of grazing (Naveh and Whittaker 1979:183).[33] Grazing tolerant species respond to grazing by tillering, thereby increasing their reproductive potential, and competing more effectively (as a species) for sunlight (ibid.; see also Iannelli 1991; Arnold 1981:137; Noy-Meir et al. 1989:307). Opening of the sward through grazing allows more room to grazed plants to respond in this manner. Discussed further below with reference to cereals, grazing induces tillering both of the upper portions of plants and of their root systems (Amato et al. 1994; Menke

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[32] A sward is the plant cover on pastures/grasslands considered as a whole, a concept similar to canopy with respect to forests.

[33] Many authors have noted that cereals and legumes are opportunistic species, fire-adapted colonizers of disturbed habitats, pyrophyllic colonizers of environments (e.g. Lewis 1972; Forni 1979, 1980, 1982, 1984; Bianco 1960; Mazzoleni and Pizzolongo 1990; Kuhnoltz-Lordat 1939:31-58). Forni (e.g. 1979, 1984) identifies a common linguistic root of 'fire' in words associated with tilling (e.g. *arare*) and with domesticated animals, suggesting that both cereal cultivation and animal husbandry both developed from the application of prescribed burning (see also Sereni 1953).

1989:192; Pardini 1992:293). Such tillering of upper plant parts provides increased fodder and seed production:

> . . . there was a tendency for all species to set more seeds per plant under high stocking rate than under low stocking rate. A possible explanation could be that defoliation [grazing] increased seed production probably because of increased branching . . . (Russi et al. 1992a:769).

Those individual plants which respond to grazing by tillering (both above and below ground by increased root development) have a competitive advantage over other plants lacking this genetically transmitted characteristic (Noy-Meir 1992; Naveh and Whittaker 1979:183). A response to grazing by root growth (increased root area index) favours their ability to capture limited water resources over other plants in the micro-environment with which they compete (see also Pardini and Pardini 1992:535 for clover example). This is especially important in semi-arid and arid regions where precipitation is poorly distributed and unpredictable, and where the predominantly clay soils have low permeability (e.g. Hall 1920:327-330; Caliandro and Catalano 1991). Finally, the opening of the sward through grazing also provides better conditions for the setting of seed, a larger proportion of which falls more readily to the soil surface and is set by the action of scarifying hooves (see Curll and Jones 1989:345-346; Jones 1987:35, 51).

> Manipulation of the environment through timely soil disturbances ['tillage' in their example, hoof action and fire in mine] may break environmentally induced seed dormancy of some species, and thereby differentially control the composition of the emergent vegetation (Forcella and Gill 1986:71).

In areas with clay-based soils, *pastori* avoid taking their flocks over the same areas when the pastures are wet because, during those limited periods, a concentration of hooves compacts the soils and consequently inhibits seed penetration. When the soil surface is dry, however, the opposite holds true (see Brogi 1984:37). *Pastori* maintain that under normal (dry) pasture conditions, ovicaprids' hooves serve to scarify the soil surface, loosening the soil for seed yet to drop, and burying seed already on the soil surface or in the herbaceous mat where this has not been cleared by fire.[34] In essence, the flock's hooves serve to set seed (see also Pardini 1993; Pardini et al. 1994; Harrington 1981:184; Jones 1987:35). Moreover, the hooves scarify the soil surface which cover seed and incorporate faecal pellets and plant residues into the soil surface increases water penetration during infrequent and brief precipitation events, while at the same time the hooves (Jones 1987:51). The shallow root systems allow rapid absorption of this moisture.[35]

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[34] The dried mat is generally eliminated through burning, allowing seed pods and loose seeds to drop to the soil surface. These claims by *pastori* are supported in Berner and Wollesen's (1993:47-48) study of manure in which the authors note the importance of soil scarification by hooves in incorporating dung into the soil.

> One can therefore postulate that the impact of grazing upon the vegetation will vary with the degree, frequency, and time of grazing; with the mix of plant and animal species present; and with environmental conditions. Response to changes in floristic composition and structure will reflect modifications in competitive relations caused by the complex of factors in which animals often play a primary role. Tolerance to very heavy grazing may be exceptionally high where strong selective pressures have been operative for a long time -- as in the Near East and much of Africa" (Jones 1987:35-36).

Pastures are therefore composed of those species best adapted to the particular grazing and burning regimes under which they are managed. Cocks (1985) concluded from his experiment in transferring forage legumes from one region into another, that the most successful forage legumes are local ecotypes, adapted to a particular agro-pastoral system. Moreover,

> . . . the most striking features of wild populations are firstly that they vary from place to place, and secondly that they are diverse, even within local communities. Often the diversity is a manifestation of temporal change. In either event it indicates a close adaptation to local environments (Cocks 1985:100).

Cocks' study reveals the complexity of relationships between flora, fauna and farming systems. The site-specific nature of legumes' adaptation was shown to extend beyond neighbouring plant communities, soils, precipitation, temperature, and so on, to the particular agro-pastoral system (Cocks 1985). Groves (1991:436; see also Groves 1986) arrives at similar conclusions, but argues further that the success of mediterranean invasive flora (forage plants) is based on their pre-adaptation to prescribed burning, controlled grazing, and 'low soil nutrient' conditions as much if not more than the adaptation to climate (rainfall and temperature) conditions. The 'spontaneous' (i.e. 'wild') vegetation dominating *saltus/silva* is composed of plants that have been selected for through human management practises of controlled grazing and prescribed burning. These are in fact, highly managed pastures.

Year-round grazing of sheep and goats has a profound effect also upon forest vegetation. As noted above, ovicaprids consume seeds which then are deposited in their faecal pellets across environments, including within the oak and beech forests that are characteristic of this region.

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[35] For the importance of soil scarification in South Italy, see Caliandro and Catalano's (1991) discussion of dryland farming in clay soils.

> Goats are also utilized as biological control for brush and undesirable forbs. The browsing, if controlled, accelerates vegetative growth of trees, shrubs and surface vegetation. . . . The goat acts as seeding machine of trees, especially hard-coated seeds which would not germinate unless acid treated; such seeds while passing through the animal get their hard coats softened and get pelleted. These pelleted seeds have greater germination capacity (Acharya 1992:49).

Grazed together with sheep in forested pastures, goats perform an important role in cleaning the environment (Cuartas and García-Gónzalez 1992; Narjisse 1991:19; Jones 1987:141-142). *Pastori* emphasized the role of goats in browsing back bushes that sheep leave untouched and the lower branches of trees, thereby removing impediments to sheep (see also Croce 1930:179; Naveh 1982c:136).

> The presence of the goat in amongst sheep is recommended, and we suggest necessary, particularly in uneven terrains . . . they open the way for sheep (Portolano 1987:11, my translation).

Goat control of bush growth (Harrington 1981:185) and elimination of lower branches of trees also reduces the possibility of fires reaching the tree canopy (Acharya 1992:56; Narjisse 1991:19). Their browsing also assists tillering of the upper portions of trees (Acharya and Bhattacharya 1992:171). Sheep and goats jointly clean the forest understorey and control the amount of dry matter accumulated as forest litter, thereby reducing the potential for destructive forest fires.

It is clear from Hughes' (1983; see also Hughes et al. 1982) study of Roman attitudes towards forests, that these were highly managed environments. As is the case today, trees were selectively cut, and groves were important grazing resources for ovicaprid flocks: ". . . literature and art represent groves as full of sheep and goats" (Hughes 1983:443). On the basis of my observations of unmanaged copses and information supplied by informants, sheep would not have been able to enter unmanaged forests. The grazing in groves of mixed flocks described in ancient texts (Virgil, *Georgics* 3.332-334; Columella, *De res rustica* 7.3.23) indicate that goats probably maintained an open grazing environment for sheep in the same way they do today.

The positive effects of browsing by goats in the circum-Mediterranean oak forests has been documented in a number of studies (see Cuartas and García-Gónzalez

1992; Perevolotsky 1989) which suggest that the dominance of holm oak *(Quercus ilex)* and *Quercus pubescens* in the region's forests can be attributed to the lengthy history of human management by fire (see also McCarthy 1993:220-224 for traditional burning of oaks in California by indigenous groups) and grazing of ovicaprids (Naveh 1982c:136).

> In fact, the area in which domestic Caprini have evolved coincides partly with the distribution area of the *Q. ilex* . . . . The wide capacity for sprouting after cutting and fire is a well-known feature of the holm oak" (Cuartas and García-Gónzalez 1992:317).

One informant reported that his flock had gotten into one of his two olive groves and was only discovered after the goats had managed to browse the olives thoroughly. Avoidance of vineyards and olive groves during grazing is universally practised by *pastori* because local knowledge has it that goats damage these plants. This unfavourable view of the effect of goats' browsing on vegetation is of great antiquity (di Bérenger 1965:253). Trimmings from olives are commonly used as fodder during lean periods in winter (see also Koster 1977:191; Mee et al. 1991:230), but it is the "bitter" tooth of the goat which apparently renders it unsuitable for browsing in olive groves. Everywhere the goat bites, informants explained, the bite-site will dry up. However, in recounting the incident of the escaped flock, the *pastore* described how those olives, which were in poor condition before the goats had an illicit browse, produced a crop of olives exceeding those of the other, established olive grove the following year. This abundant harvest, he attributed directly to the goats' browsing. When I questioned the *pastore* about the conflicting information regarding the "bitter-toothed" goat, he explained that a minimal amount of browsing was beneficial, but anything more was harmful to the trees. While the bite site may dry, this pruning by goats induces growth in the "upper portions" of the trees (Acharya and Bhattacharya 1992). The traditional aversion to goats' browsing on olives and in vineyards might be better explained by another factor raised by informants to explain the avoidance of olive groves and vineyards:[36] that *pastori* typically graze others' lands and any question of damage to olive groves or vineyards leads to conflict with the landowner, and a consequent loss of access to grazing.

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[36] Although I can find no information regarding the effects of goats on vineyards I expect that the fact that goats can easily reach even the tops of these plants would eliminate the possibility of beneficial grazing during the growing season. In Greece, Forbes (1982:242) reports that vineyards are grazed by mixed flocks. The cuttings from the vines are stall-fed in Basilicata, but, I did not witness any grazing of vineyards.

Contrary to doctrine maligning the goat,[37] the conclusions and observations supplied by informants are supported by recent studies (below).

> Goats also help in dispersal of grass, bush and tree seeds. They consume grass and bush seeds and fodder tree pods while grazing/browsing and defecate hard coat undigested seeds especially of pod bearing and xerophilic trees after providing acid treatment while passing through digestive system and fortifying with nutrients in the form of faecal pellets and spread such pelleted seeds more uniformly all over the grazing land. These seeds germinate in large numbers as soon as soil moisture conditions are favourable. . . . The goat saliva left on bitter foliage adds nitrogen directly to the plant cells inducing quick regrowth. Saliva is also said to detoxify the high tannin content available in many of the tree leaves found in desert areas. The biting of tender leaves/twigs by goats also induces tillering (Acharya and Bhattacharya 1992:171).

Fire is one mechanism whereby seed germination is triggered (see Keeley 1995). However, grazers also have a significant role in enhancing germination of hardseeded, drought resistant species.[38] Through digestion, which subjects seeds to heat and digestive enzymes, seed coats are rendered more permeable and are thereby germination-enhanced (Russi et al. 1992a:769). Consequently, in speaking of the colonizing role of sheep and goats, I refer not only to their selective influence on a localized plant community, but also to their dispersal of germination-enhanced plant seed from one area into another. Hence, Rindos' (1984:115) discussion of "human-mediated" coevolutionary dispersal relationships is relevant to the role of sheep and goats as specialized dispersal agents described here.

> *Specialized* agents . . . have developed a close relationship with a given plant species and depend on it for at least seasonal subsistence (Rindos 1984:115).

In the vegetation mosaic through which a *pastore* daily moves his flock in Basilicata, many diverse plant communities are traversed by the grazing animals. As prodigious producers of faecal pellets (Baticle 1974:34; Cherry 1988:21),[39] these grazers disseminate seeds across vegetational zones, and in this way help to regenerate and shape pasture plant communities (see also Baticle 1974:51; Curll and Jones 1989:346,348).

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[37] Selwyn (1995:126-128) presents a fascinating analysis of the political rationale behind the demonization of the goat in Israel. However, the dominant rationale for perceiving goats to be environmentally destructive results from their ability to survive in already degraded landscapes. Consequently, they have come to be associated with poor vegetation zones and erroneously considered the cause of the 'degraded' plant communities/landscapes. Such erroneous conclusions led, in Italy, to disincentives for goat husbandry until the 1950s and 1960s (Matassino et al. 1987:3). A relatively early paper in defence of the goat, describing its role in simple terms in the Turkish *macchia*, is Kolars' (1966).

[38] "Annual legumes such as subterranean clover (*Trifolium subterraneum*) and several species of *Medicago* owe their success in perennial pastures to an ability to set seed before the summer drought. This seed can survive recurrent periods of dessication and heat, and still germinate after cool conditions are restored" (Wilson 1981:266; see also Reed et al. 1989:77).

> The fact that a substantial fraction of the legume seeds ingested by sheep are viable when excreted, protects the seed bank and so sustains pasture productivity (Russi et al. 1992b:776).

A comparative study of productivity in 104 'natural' pastures in extremely diverse physical and climatological conditions throughout the Italian peninsula, Sicily and Sardinia (Cavallero et al. 1992) revealed that pasture production was less determined by physical and climatological factors than traditional models predict. Among the environmental factors affecting pasture production, altitude was the most significant; productivity was related directly to temperature and only secondarily to the physical and chemical characteristics of the soil. The authors conclude that the "comparative[ly] poor role played by the soil and climatic factors, may be due to the strong past and present antropic [*sic.*] influence, related with management and utilization techniques" (Cavallero et al. 1992:326). Thus, pedoclimatic variables are lesser predictors of pasture productivity than was supposed, and their effects appear to be mitigated by human management of pastures and their utilization.

> In fact, in almost all of the cases examined, pasture vegetation is of secondary origin [introduced] and is an expression of age-old use as pasture which has more or less modified and masked the role exercised by environmental factors. Consequently, the bioclimatic zones, frequently applied in the fields of botany and particularly in forestry, are poorly adapted to describe and predict pasture plant production (Cavallero et al. 1992:339).

The established, 'native' pastures such as those described in the above study are in fact anthropogenic, created through the integrated use of fire- and grazing-selected species (see also Baticle 1974:53-54; van Zeist 1991:122). The close interrelationships between grazers and pasture plants implies a lengthy history of interactions, of reciprocal adaptations. Over the millennia, ovicaprid grazing of spontaneous, 'natural' pasture has acted to select for reproduction particular plant species at the expense of others, such that these "marginal" lands are rich in legume species (Osman et al. 1990:205). These species have in common mechanisms that insure their reproductive success under grazing and burning regimes.

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[39] Baticle (1974:34) estimates that one sheep produces in the neighbourhood of 500 kg of manure each year. Cherry's (1988:21) estimation is similar: sheep producing *c.* ten times their weight in dung per annum. Excretion of seeds begins as early as six hours following consumption, and continues for *c.* the five days following (Russi et al. 1992b:774).

One such study of Mediterranean pasture response to grazing measured seed bank dynamics (Russi et al. 1992a).[40] The results showed that a high stocking rate enlarged seed bank size mainly through increases in the number of small-seeded legumes (ibid.:767, 770; see also Rubino et al. 1988:101-102). The authors postulate that the elevated yield may be the result of increased tillering of plants responding to grazing and hence greater seed production (1992a:769; see also Wolfe 1985:26), and to the passage of small, hardseeded legumes through the digestive processes of the ruminants (sheep, in this study) which enhances their ability to germinate (see Russi et al. 1992b; Thomson et al. 1988:139). Other possible contributing factors which the authors note but do not discuss, are increased seed burial through trampling and the effects of heavy grazing in creating gaps in the herbaceous cover which are readily colonized by annuals (Russi et al. 1992a:769).

Pardini (1993) and Pardini et al. (1994) arrive at similar conclusions. In the Maremma area of Tuscany, fire breaks were oversown with two species of clovers (*Trifolium subterraneum* L. and *Trifolium brachycalcium* Katzn. & Morley) in an experimental effort to use sheep and cattle to reduce the vegetative regrowth in the fire breaks (Pardini et al. 1994). The study results revealed sheep to be the better consumers of the herbaceous vegetation in the fire breaks. Sheep also ingested more seed, but digested proportionately more of what they ingested than cattle. Both spread germination-enhanced seed throughout the forest pasture, thereby colonizing the zone with favoured forage (clover).

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[40] An important result of this study was its demonstration that seed bank species and their relative proportions are unlikely to be closely correlated with their representation or abundance in the current vegetation (Russi et al. 1992a:770). This underlines the importance of seed banks, seed dormancy, and the flux of species from year to year depending upon the climatological, environmental conditions such as temperature, precipitation, use of fire, depth of burial, and so on. Therefore, a better measure for predicting pasture productivity is the seed bank rather than current, standing vegetation. This is also concluded in another sheep grazing and pasture response study (Milton 1994) which further shows that sheep do not affect survivorship of seedlings nor of mature plants upon which they feed. The increase in unpalatable species found by Milton (1994:26) is likely the result of a lack of management by controlled burning and/or cutting.

> Seeds eaten by livestock are mostly digested; they provide significant nutritive value because of their high protein content . . .. For certain plant species, however, a consistent fraction of seeds ingested by small ruminants is able to escape digestion and is thus returned to the seed bank (Russi et al. 1992b:772).

In a previous research project, Pardini (1993) studied the effect of sheep grazing on clovers (the same species as above), concluding that seed production was greatly enhanced by the grazing as opposed to seed yield following cutting the clovers for hay. Grazing was seen to enhance both clover germination and tillering (see also Wolfe 1985:26). Germination was further improved by the action of the sheep's hooves in burying seed, thereby increasing the survival rate of germinated seed[41]. Effects to the clovers under continuous grazing over the three year trial included increased density (canopy-sward structure) of tillered plants, increased hardseededness,[42] and higher seed production. Pardini (1993) also added that the clovers produced high quality forage during a peak period of forage shortage (summer). The authors conclude from both studies that the results obtained are due to the trampling of seed which provides better burial and hence enhanced reproductive success; increased tillering through grazing; and the germination enhancement of seeds that have undergone consumption and excretion. Small seededness is another adaptive characteristic.[43]

> Small seed size is an important factor in increasing the likelihood of seeds escaping mastication, as is hardseededness in the resistance to consumption by digestive enzymes (Russi et al. 1992b:776).

I noted a similar effect of high stocking rates on open oak forest pastures grazed by Podolian-cross breed cattle. Medics and clovers form a dense mat in these pastures. I noted successfully germinated legumes in the cattle dung which also contained complete medic pods and acorns. The stocking rate was well in excess of that recorded in the municipal *Fida Pascolo*[44] registers and despite being intensively grazed (the cattle also browse the lower branches of the oak trees), the pasture was far from 'degraded'. Métaillié (1978) describes similar conditions in periodically burned mountain pastures in France:

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[41] The same has been documented for medicks: ". . . a high proportion of the [medick] pods are trodden into the ground by sheep and protected from overgrazing" (Chatterton and Chatterton 1989:65).

[42] I suspect that the increase in hardseeded clovers is the result of selection through the complete digestion of seeds with a thinner testa (seed coat) and the survival of the ruminant digestive process of those seeds with a thicker testa (harder seeds).

[43] The proportion of small-seeded species in the seed bank increased with higher stocking rates (Russi et al. 1992a: 770) – a result linked to the higher probability of small seeds escaping mastication and hence being redeposited in the faeces. The authors also propose that larger seeds are preferred and thus more likely to be consumed while their size renders them more likely to be destroyed through mastication. Not only is it more likely that small seeds will pass into the digestive tract intact, but they are also more likely to fall to the soil surface and be buried.

> It is the action of flocks which has determined the evolution of the environment [plant community composition]. If there is overgrazing, there is damage: impoverishment of forage species, erosion due to trampling, etc. If there is under-grazing [too low stocking rate], there is a rapid recolonization . . . [of woody species] and deterioration of pasture potential. Between the two is established a precarious equilibrium, attained on very localized surfaces where the flock prevents the return of woods and maintains an herbaceous mat" (1978:520).

In this same pasture, domestic pigs also forage freely. Traditionally, the area has been grazed by a mixture of cattle and pig.[45]

Another example of ovicaprid efficacy in colonizing environments with species favoured by these grazers, the forestry service planted *Hedysarum spinosum* along earth dams constructed to stop land slides in an area of the Tolve communal grazing lands. When I remarked upon the plant while out with a *pastore*, he informed me that in the five years since this plant was introduced by the forestry service, it has been spread throughout the pasture by his mixed flock. It has become a dominant component of the pasture. This example of the diffusion of a single species is suggestive of not only the capacity and importance of these animals in establishing plant communities composed of species that are of greater forage value, but also of their role in continually disseminating species from one area to another (see Russi et al. 1992b:777).

Current research at the Università degli Studi della Basilicata (Dr. Lorenzo Salamone, personal communication) demonstrates that the species, *Acacia*

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[44] *Fida Pascolo* is the rental of common grazing lands for which a minimal tax/head livestock is paid. Through this system, numbers of animals grazing a given area are controlled (see Appendix B *Fida Pascolo* records for the effective stocking rates; c.f. Money-Kyrle 1957:67, Turkish example; Heltzer 1976:34 for ancient Syrian common grazing).

[45] With reference to overgrazing in common lands, the so-called "tragedy of the commons" (Hardin 1968), not one Basilicata informant considered common lands to have been 'degraded' by overstocking. In fact, Koster (1977:182) argues in his study of Greek pastoralism that the *pastori* he interviewed were fully cognisant of the consequences of overstocking to pastures, and were mindful of the economic repercussions to them should the common grazing lands be depleted. Hence, overstocking in common lands is not a long term problem, although it may be a short term necessity (see Chang 1992:77).

pseudacacia (imported in 1601) has been spread in south Italy almost entirely by ovicaprids. Because of its relatively recent introduction to Italy, it is possible to map its path of colonization, particularly in Calabrian pastures. Salamone's initial findings indicate that the success of this plant in colonizing environments otherwise hostile to its reproduction is attributable to the consumption of seeds and seed pods by goats (his study is restricted to goats). The digestive tract provides the necessary temperature and humidity otherwise unavailable in the physical/climatological environment, softening the seed coat, and thus providing the necessary preconditions for their germination. This is also true of another introduced species, *Amaranthus retroflexus* (Le Floc'h 1991:69) which requires a nutrient-rich environment, heat and humidity for successful germination (Francia 1990). Commonly, these plants growing in vineyards and vegetable gardens are pulled and fed as fodder to sheep and goats. Their manure and the seeds within, are returned to the same soil. Their abundance in the faecal pellets thus far analysed, and the fact that they have become a common "weed" in many manured vegetable gardens and vineyards (personal observation), attests to the efficacy of ovicaprids in selecting and enhancing favoured forage, and in spreading these to new environments, colonizing new areas.

> In addition, the various species of domestic livestock have many subtler effects on the vegetation, which are only partly understood. (For instance, seeds of many leguminous plants -- trees such as *Acacia*, shrubs such as *Retama* and annuals such as *Trigonella* -- are dispersed by livestock which eat them; apparently they are also made more germinable by passing through the intestines of livestock.) In many ways, the present vegetation of the semi-arid region is well adapted to co-exist with a domestic livestock population . . . (Noy-Meir and Seligman 1979:137).

Lorenzo Costantini's[46] (unpublished) study of Baluchistan goat herders' local knowledge is a clear example of the use of goats as tools. His research reveals how goat herders use their flocks to sow acacias in the desert environment. The climatological conditions necessary for acacia seed germination are entirely absent, and goat herders in that area purposefully colonize this inhospitable environment with acacia for fodder by feeding acacia seed pods to their goats. The goats are grazed at the desert ecotone where they excrete in their faeces the proportion of seeds not masticated during consumption, sowing these germination - enhanced seeds, and thereby expanding their grazing resources while colonizing new areas with acacias (Costantini, personal communication).

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[46] Personal communication, ISMEO, Rome, Nov. 1994.

> Goats ruminate less thoroughly than sheep or cattle and food passes more quickly through the gastro-intestinal tract. Seeds of preferred species thus pass through the gut more or less intact and capable of germination. Goats can therefore be used to seed denuded areas with preferred fodder species (Wilson 1987:926).

The implication of Wilson's (1987) study is that goats excrete more seeds than sheep. Preliminary results of seed extraction from sheep and goat faecal pellets I collected do not demonstrate this, nor did informants believe there to be any difference between the two types of manure. However, definitive conclusions await completion of the ovicaprid faecal pellet analysis.

The preliminary data from the faecal pellet sampling also reveal that mature seeds are consumed from dried forage legumes even when fresh, green plants are available. Whereas *pastori* had identified the role of sheep and goats in disseminating seeds across the landscape, the presence of mature legume seeds in the faecal pellets led me to pose more specific questions about ovicaprid preference for mature legume seeds. Subsequent information provided by *pastori* indicates that ovicaprids graze these plants when they emerge in spring, after which they are for the most part left alone because of the abundance of forage that becomes available, and then these animals return to graze the same plants once they have gone to seed (see also Fedele 1990, below). Grazing pressure on these plant communities over the millennia has probably favoured successful reproduction of plant species most palatable to grazers with such properties as hardseededness. Hardseededness promotes the survival of seeds which, once ingested, are germination - enhanced by virtue of passage through the ruminant digestive tract .[47]

> According to Piano (1987), high levels of flexibility [are] required [in] the grazing systems of the Mediterranean environment where pasture rich in annual self-seeding legumes are often formed of many species which, in terms of survival, respond differently to different grazing regimes, and botanical composition may vary from year to year (Bullitta et al. 1993:68).

Bullitta et al. (1993) report a significant increase in the number of annual legumes throughout the four year study of pasture response to sheep grazing in Sardinia. Reported to mature precociously under drought conditions (Bullitta et al. 1993:70), such legumes appear within the ovicaprid faecal pellet samples I collected. The aforementioned studies, data supplied by informants, and the results of ovicaprid faecal pellet samples, document the important role of ovicaprids in enhancing the germination of legume seeds, in the tillering of plants (including grasses) and in the colonizing of new environments. The capacity of legumes to set seed even under drought conditions, and the effect of ruminant consumption of such seeds is characteristic of a mutualistic relationship.

Pasture plant communities have been subjected to selection under conditions of controlled burning and grazing such that their successful reproduction and the maintenance of productivity are reliant upon these technologies (Snaydon 1981:17). Under conditions of extreme variability in precipitation and its distribution, maintaining the balance necessary between stocking rates and pasture production requires the application of these technologies, both now and in the past. The management technologies of prescribed burning and controlled grazing are essential to the formation and maintenance of the pastoral ecosystem.

Consumption and later excretion in dung is not the only mechanism whereby sheep and goats disseminate seeds from one area, to colonize another. Historically documented cases of the fortuitous introduction of medic pods (particularly *Medicago polymorpha*) into Australia, for instance (Kloot 1991:134; Heyn 1963 in Olivieri et al. 1991:147, 151 for the introduction of *Trifolium subterraneum*; Groves 1991:428-430; Brownlee 1985), occurred by way of pods clinging to the wool. This mode of colonization is effective only if the conditions are present in the colonized area for germination. For example, Le Floc'h (1991:74-75) recounts how numerous plant species were introduced into France through wool imported, washed in hot water and then laid out to dry in adjacent meadows. The majority of introduced flora disappeared after wool-processing was discontinued. As Le Floc'h (1991:74) remarks, the washing of the wool in hot water probably had much to do with the initial successful germination of the seeds it contained. Without the germination enhancing moisture and heat (conditions absent in the environment), the plants did not reproduce successfully.

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[47] Initial results from faecal pellet samples collected in the course of field work support these findings. Seeds removed from these samples indicate that legumes are particularly resistant to destruction during the ruminant digestive process (e.g. *Medicago* spp., *Vicia* spp., *Trifolium* spp., *Melilotus* spp.). To a lesser extent, so are some other forbs (e.g. *Sinapis* sp.) and *Graminaceae* (e.g. barley, *Phalaris; Lolium*). In processing the samples, a significant proportion of the seeds started to germinate (to my chagrin), underscoring the extent to which they are "germination - aided" by their ovicaprid consumers. Again, a mutualistic relationship can be said to exist between plants producing palatable hard seeds, a proportion of which are not masticated (remain intact) and are germination-aided having passed through the digestive tract, and the ruminant consumer which benefits from the remaining proportion of palatable, nutritious seeds which are consumed -- those masticated and seeds with softer coats which do not withstand the digestive enzymes (see below).

Transport of seeds in wool has important ramifications for the introduction of seeds from one geographically isolated area into another. However, after the introduction of seeds, their success is dependent upon local conditions. In the case of highly palatable forage plants, evidence presented below illustrates how the introduced plants are disseminated after introduction by ovicaprids managed under traditional grazing systems.

> The types and breeds of livestock of the Mezzogiorno have value generally constituted by their rusticity and adaptation to the environment (Croce 1930:217, my translation).[48]

Pasture plant composition has an equal selective influence upon grazing ungulates (e.g. Croce 1930:14, 63, 79; Matassino et al. 1987:2; Acharya and Bhattacharya 1992:198-199; Arnold 1981:97-99). Within any ruminant populations, individuals possess genetically transmitted variations in the composition of their digestive enzymes which give them variable capacities to digest efficiently different forage plants (Russi et al. 1992b:777).[49] "In ruminants the micro-organisms within the rumen are adapted to a particular diet" (Saville 1981:342; see also Masson et al. 1991:147). Jones (1987) describes the mutual adaptations of interacting species along lines similar to Lewontin (1981).

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[48] Local breeds are remarkably well adapted to locally available forage resources, possessing, according to Iannelli (1986), invaluable genetic material, the animals modelled by their environment (Iannelli 1986:143-144). See also Baticle (1974:62).

[49] These differences also act on plant communities, not only in species consumed, but also in variable effects of digestive enzymes -- for example, in breaking down seed coats (Russi et al. 1992b:777). This is important when considering seed survival.

> Still another type of change results from the evolution of new characteristics and species, which usually replace older ones. . . . Those species best adapted to the extremes of their living conditions survive, altering their gene frequencies, their population characteristics, and the system in which they live. As one species evolves, others react; thus the structure and function of the whole assemblage changes through time (Jones 1987:28).

All flocks under traditional pastoralism are composed of individuals selected by *pastori* because they perform well in the complex of micro-environments (and their plant communities) which comprise the pasture system.[50] In other words, selection is based upon the animal's genetic predisposition to consume and metabolize effectively available forage (Matassino et al. 1987:2, 21; Acharya 1992:53). Under stressful circumstances such as drought induced low forage availability, only those animals (local ecotypes) with sufficient reserves and the greatest ability to extract sufficient nutrients at low metabolic cost from the available forage will survive.[51]

The selection and consumption of forage by animals varies throughout the year depending upon individual nutrient requirements and the seasonal availability and condition of forage (Masson et al. 1991). Animal nutritional requirements are extraordinarily complex and difficult to capture; models so far, have proven inadequate and most feeding and breeding experiments are geared to divining feed programs that fulfill the complex nutritional requirements of stall-fed animals (Georgievskii et al. 1981a; Wheeler 1981:241). *Pastori* select breeding stock within their flock on the basis of the animal's ability 'to do well', and emphasize that for an animal to do well, it must "touch" all the available plants.[52] After a few generations, flocks tend to be composed of individuals born to a few progenitors which are identified as best suited to the grazing environment, that is, possessing a demonstrated superior capacity to process efficiently the available vegetation, measured by general health, weight gain, milk production, reproductive capacity, and so on. The close relationship between plants and their consumers is manifest in the results of a current study of local Podolian-breed cattle which are shown to make more efficient use of indigenous flora than do more recently introduced cattle breeds (Gambacorta, unpublished research; Arnold 1981:136; Coombe 1981:328). The information provided by Basilicata *pastori* is consonant with animal husbandry studies. Acharya and Bhattacharya (1992:198-199) write that: "[a]daptation of breed to the local environment should be the key element in the choice of breed and in determining breeding strategy" (see also Narjisse et al. 1991:226-227; Masson et al. 1991 for the importance of local breeds; Rubino et al. 1988:99-100,102). Moreover, selection to 'improve' breeds by animal scientists are based upon local stock where these animals rely on 'native' pastures (e.g. Ankarali 1988; Aboul-Naga and El-Serafy 1988).[53] Individual variability within flocks (Manfredini 1992c:184) is a factor that *pastori* monitor, selecting with each batch of lambs and kids those healthiest offspring of the best milk and meat producers, and the most fecund ewes.

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[50] *Pastori* trace each individual animal's bloodline within their flock. In a southern Greek example, "[r]egular culling proceeds with an attempt to select the strongest lambs from the mothers with the best production histories" (Koster 1977:294; see also Koster 1977:204).

[51] Under stressful drought conditions such as those that occurred in Apulia the winter of 1994-1995, the combination of poor forage and cold resulted in the loss of a number of animals. These individuals were probably those which were weaker at the outset and were expending more energy than the survivors in digesting the available forage. In such cases, energy expenditures in grazing scare pasture resources are higher than metabolized forage consumed (e.g. Jones 1987:36).

Notwithstanding this genetic determinant, other factors impinge upon any straightforward analysis of plant-animal interactions: different breeds demonstrate different preferences for different plants (Arnold 1981:97); individual animals also have personal food preferences (ibid.:99); animals are socialized within their flock and develop the feeding behaviours of that flock (described below; Narjisse 1991:15-16).

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[52] A description of the sheep and goat breeds typical of Basilicata appear in Chapter 4. See also Iannelli (1989:43). Factors affecting animal performance (its ability 'to do well') in making optimal use of available pasture are complex, interacting variables such as breed, reproductive state, age, and particularly their permanence on pastures (Verità and Cianci 1992:95; see also Georgievskii 1981a, 1981c for nutritional physiology). The complexity of animal nutritional needs are made clear in the context of stall-fed animals where feed concentrates attempt to mimic the animal's ability to seek out the necessary but fluctuating nutrient requirements (see Wheeler 1981:241; Georgievskii 1981c; Manfredini 1992a, 1992b).

[53] Worthy of mention in this context are the following findings: ". . . Rahmani sheep are specifically adapted to the conditions of the North Delta while the Ossimis are more generally adapted to conditions in the valley . . .. The intensive agriculture in the Delta has not improved the performance of the Bakri sheep which were adapted to the arid conditions of the desert" (Aboul-Naga and El-Serafy 1988:165).

Overall, "grazing is a complex system, a combination of interconnected factors that act over the long term with selection acting upon both plants and animals, resulting in the most productive, advantageous use of species" (Gambacorta, paraphrased personal communication).

I observed another interesting facet of the impact of sheep and goats upon their grazing environment: foraging behaviour varies with flock composition and environment (see also Narjisse 1991:16-17 and Koster 1977:189). Where sheep and goats graze together as a single flock, their feeding behaviours differ. Both species will browse brush and lower twigs/branches of trees. Those flocks composed entirely of sheep, but raised and grazed daily in wooded pasture exhibit more browsing behaviours than anticipated for sheep. In fact, they behave like goats. However, in mixed flocks, sheep tend to remain in the open glades, at the centre of the flock, while goats forge ahead and along the herd's edges, alternately browsing and grazing (see Portolano 1987:11). These observations suggested to me that foraging behaviour is learned and therefore specific to an established grazing regime.

Often found in among other sheep is an old ewe, tottering after the flock. This ewe inevitably was identified as the great-grandmother of most, if not all the flock. While sentimentality enters into *pastori*'s decision to keep these old ewes, they always insisted to me that the ewe still managed to lamb and produce milk. However, *pastori* also emphasized the importance of socialization which enters into decisions regarding the replacement of older animals -- that old dams are central to the social unit of the flock which is structured on the basis of family groups (see also Koster 1977:293-295, 300). They remarked that adults brought into new environments do poorly whereas their lambs or kids learn what to consume and when, avoiding certain toxic plants at the right moments (see also Narjisse 1991:16; McDonald 1981:350-351). According to these informants, moving flocks to new grazing environments inevitably reduces productivity because of the different forage composition and its growth stage (see also Verità and Cianci 1992:95). In the Greek instance, Koster (1977:287-288) describes this phenomenon as "home range behaviour". The familiarizing and permanence of flocks on pastures Koster notes, is important for maintaining productivity of the flock, illustrated through one *pastore*'s experience in moving his sheep to other pastures:

> This experiment was a disaster. The sheep evidenced numerous signs of disorientation -- sluggish grazing, searching behavior, and increased calling to

> one another. After two months, this had resulted in the "wasting away" of twenty ewes and loss of lambs through mismothering. The shepherd decided that he had no choice but to return to his traditional [pasture area]. He did this at a considerable loss financially . . . Once the flock was returned to their customary winter pasture . . . they no longer displayed disoriented behavior, and flock production rose accordingly (Koster 1977:289).

Socialization of animals to a grazing regime and environment has been well-documented; grazing behaviours are learned and environmentally (vegetation form) specific (Pollard 1992:233, 238; Narjisse 1991:15-16; Narjisse et al. 1991; Fedele et al. 1988:68).

Beyond a preference for grazing or browsing (partly genetic, partly learned, environmentally specific behaviour), qualitative differences in sheep and goat forage selection have been documented. According to experimental trials conducted on enclosed pasture, goats select fewer green legumes than sheep (Clark et al. 1982; Nicol et al. 1987; Frame and Newbould 1984:26-27). Fedele (1990) similarly found a lesser preference for green legumes among goats. According to Fedele, these differences can be attributed to domestication. The more 'archaic' the animal, the broader its forage base (Fedele, personal communication; see also Cuartas and García-Gónzalez 1992:325).[54] Sheep have been subjected to greater selection (domestication) than goats, and therefore have more restricted dietary preferences.

Table 6: Percentage dietary composition by vegetation category (Fedele 1995).[55]

	Spring (Sheep)	Spring (Goats)	Summer (Sheep)	Summer (Goats)	Fall (Sheep)	Fall (Goats)	Winter (Sheep)	Winter (Goats)
Trees	3%	5%	18%	76%	14%	45%	8%	38%
Shrubs	2%	7%	11%	11%	10%	27%	4%	28%
Grasses	95%	88%	71%	13%	76%	28%	88%	34%

Summarized in the table, results of a Basilicata study above reveal differences in seasonal forage preferences between sheep and goats. Only in spring does the dietary selection of sheep and goats overlap when goats engage in more grazing than browsing. Fedele's previous study (1990) demonstrates that goats show a marked preference for legumes during the summer when they seek out seed pods fallen to the soil surface. This he documented through grazing trials also undertaken in the Basilicata area. Goats were shown to forage for mature legumes seeds which they consume in significantly greater quantities than grasses during June and July when the pods are mature (Fedele 1990:47). *Medicago polymorpha* was preferred over other legumes (ibid.).[56] This is supported in Basilicata by other studies in which goats demonstrated a strong preference for dry legumes over grasses (Masson et al. 1991:145), and the significance of legumes in goat nutrition (Fedele et al. 1993). While goats selected fewer legumes than grasses during foraging over the year (measured herbage intake), legumes were found to play ". . . a more fundamental role than grasses in the pasture and in the diet. . . . they determined grazing efficiency and satisfied the nutritional requirements of the animal" (Fedele et al. 1993:316-317). What all the studies demonstrate is the goat's capacity to vary its diet and mitigate the effects of a highly variable forage base throughout the year. "Thus, goats exploit the heterogeneity of the pasture to minimize negative effects to seasonal variability of grass quality" (Masson et al. 1991:318; see also Koster 1977:189).

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[54] *Istituto Sperimentale per la Zootecnia*, Goat section (C.N.R., Bella, Potenza).

[55] Draft version, Tables 6 and 7 combined. "Grasses" refers here to grasses, legumes and forbs, generally.

Nyerges (1982) argues that the keeping of mixed flocks of sheep and goats is a mechanism for exploiting the full range of available forage resources. The seasonally divergent feeding preferences decrease the impact of foraging in one dimension (grazing herbaceous plants). In this way, herders in Tauran (central Iran) are able to keep more animals than if their flocks were entirely composed of grazing sheep (Nyerges 1982:240-241). The same is documented for the Pokot of northwestern Kenya who traditionally manage pastures by periodic burning and combined herding of sheep and goats (browsers and grazers) to maintain a productive grazing environment (Conant 1982:114-115, 121; see also Jones 1987:55). The fact that only in spring are sheep and goats in direct competition for forage may figure in the decision to keep goats with sheep in Basilicata. However, the *pastori* interviewed did not identify this as a factor in their goat-keeping. Primarily, goats are kept to keep back brush and for their milk. Goats produce greater quantities of milk than sheep. Goat milk is also less fat and is used 'to cut' sheep milk, producing a favoured cheese. However, it is their role in maintaining pasture for sheep, Basilicatan *pastori* argued, that makes them valued tools. As Jones (1987) argues, the mix and relative proportion of animals with respect to each other varies with forage available, but is also dependent upon the management strategies:

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[56] Burr medics and true clovers (*Trifolium* spp.) are noted excellent dry season forage (Menke 1989:176; Purser 1981:171).

> Selecting, maintaining, and manipulating the mix of species using rangeland is both a means to greater production and a tool for molding the vegetation into desired botanical compositions and production (Jones 1987:55).

Management of woodland resources: the *silva*

> If grazing were to have been so destructive for forests, how could we explain the survival of so many degraded forests . . . reduced to the bone and yet still alive such that after a good trimming they manage to regain vigour. It is the case that for at least 2500 years the rural Italian populations send their livestock into the forest!
>
> De Berénger [*sic.*] tells us that the woods during the Roman period were divided in «saltus» (grazed forests) and in «lucus» (sacred forests), but leaving us to conclude that the «saltus» formed the bulk of the forests (Gambi 1984:18, my translation).

Lewthwaite (1982) points out that oak forest in the Mediterranean have commonly been overlooked in studies of human subsistence. This holds true for analyses of the role of forests in agriculture and pastoralism in the Italian south. The forests in the area studied are dominated by oaks[57] and are an integral component of the year-round grazing. Communal forest resources are and have been historically the subject of government legislation and management (e.g. di Bérenger 1965). Today they continue to be a valued resource for the community as a whole, despite the widespread adoption of fossil fuels by households. Managed differently from other pasture areas, these are true anthropogenic forests. While it is often assumed that where forests currently stand they have always been, this is far from the case: forests are equally part of the managed, ever changing mosaic of vegetation.[58]

Woodland management strategies practised in Basilicata parallel those identified by Métaillié (1978) in the central French Pyrénées[59] and the *dehesa* system in southwest Spain (Stevenson and Harrison 1992). The *dehesa* are managed deciduous and evergreen open oak forests primarily for livestock grazing, timber and firewood (ibid.:227, 245). Although the authors do not describe the precise management technologies applied in establishing and maintaining *dehesas*, they do note the role of livestock (ovicaprids, cattle and pig) in clearing undergrowth through intensive grazing and the use of fire (ibid.:228, 240, 244; Jones 1987:141-142). The equivalent climates, vegetation types, and livestock imply similar practises to those described below. Parallel strategies are discussed by Liacos (1973) who argues for the use of prescribed burning and controlled grazing in managing and enhancing the productivity of Greek forests. Curiously, he does not examine traditional forest management practises despite having investigated the historical (textual) evidence for the use of fire in managing arable lands. This oversight aside, Liacos' (1973) experimental results show that prescribed burning significantly improves forage quality in forests, and especially colonization by volunteer legumes post-burn (1973:88). The same conclusions are reached by Naveh (1990a, 1990b) who emphasizes the importance of the traditional Mediterranean management system of grazing, burning, coppicing and cutting.

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[57] See Chapter 3. Most common is *Quercus cerris*. Also present at higher elevations are *Fagus sylvatica, Castanea sativa* (Abriola, S. Cataldo, Calvello, Anzi, Bella).

[58] Fluctuations in proportions of wood to open pasture or cereal cultivation are documented by Salinardi (1973:128) for the township of Ruoti from 1753-1959 -- fluctuations as great as 20% of the total land.

Traditional forest management in Basilicata is undertaken by the larger part of the community. *Macchia* and *gariga* vegetation (among other untilled areas) produce plants important to the community as a whole such as *Pistacea lentiscus* (for oil in the past), mushrooms, oregano and asparagus, but they are exclusively managed by *pastori* as described above. Undertaken also by *pastori*, management of forest pasture forms part of broader management practises involving a large part of the community.

In broad outline, the annual cycle of management consists of seasonally-defined activities. August traditionally marks the beginning of the period for the gathering of wood for the winter (see di Bérenger 1965:509 for laws applied in antiquity). Firewood was scarce in the past because of the constant, year-round demand for heating, cooking and other farm and household related activities (e.g. pig slaughter, tomato processing). Individuals had to pay for the right to collect wood, others jealously guarded their private forest reserves (e.g. Salinardi 1973:25). Firewood is collected all winter until March. However, the bulk of firewood is gathered/cut towards mid-November until the end of December.

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[59] Métaillié (1978) emphasizes the interrelatedness of grazing and burning as essential components in traditional French mountain agro-pastoral practise, "[o]n these pastures regularly burned for hundreds of years, even thousands of years . . . (1978:517).

Old, sick trees are cut down, favouring young trees. This also has the effect of opening the tree canopy which permits new seedlings to establish themselves and increases the growth potential of plants on the forest floor (Mazzoleni and Pizzolongo 1990:48-49). This practise of selecting out trees and shaping forest composition extends to the forests managed by the State. In a study of the San Cataldo Forest, Monckton and Campbell (1994:16) observe that trees are thinned on a cyclical basis, trees cut typically when they reach 50 but not more than 100 years of age. A forestry marshal interviewed described his role in maintaining forests as selecting undesirable trees for cutting. Part of the *Ricostituzione Boschi* (forest reestablishment) program involves a "disease/plant sickness control" cut (*taglio fitosanitario*), eliminating sick, rotten and poorly-formed trees. The goal is to insure a "natural regeneration" of the forest. Sick, "malformed", and otherwise imperfect trees are cut down, leaving space for new tree growth from seed generated by the remaining trees. This form of selection creates an anthropogenic forest: the composition of such managed forests to which the marshal referred as "natural", reflect a cultural aesthetic and use value. This is an ancient form of forest management in which trees are left to grow at select intervals and old, malformed and unproductive trees are removed (Pliny XVII.12.19; Columella IV.33, in di Bérenger 1965:423-424; Hughes and Thirgood 1982:62-63).

> For the past 2500 to 4000 years at least, pastoralists . . . have been in the habit of burning the forest in order to get better and earlier pasture growth . . . (Le Houérou 1981:486).

Small shrubs of no economic (grazing) importance are either spot - burnt (burn restricted to an individual shrub) or cut out by hand. Among these, informants noted particularly *biancospino (Crataegus monogyna)* which was often cut out and taken into town by the very poor to make carbon (coal) to be sold locally (see Angioni 1989:233-234 for coal-making in Sardinia). After cleaning by removing wood and shrubs, around the end of January and all through February, the remaining understorey (forest litter of leaves and dried grass) is burned by *pastori* to encourage new growth (see also Cappelli 1984:12). *Pastori* use fire to fertilize and stimulate fresh growth from trees (see also Trabaud 1987:607) and from herbaceous vegetation (e.g. Kuhnholtz-Lordat 1939:203-

205, 214; see also Liacos 1973; Virgil *Aeneid* 10:405-408).[60]

> Fire is a feature of this [semi-arid forest] vegetation and is usually an essential part of the management for grazing. Fire prevents the trees becoming too dense and is particularly efficacious in controlling shrub size and density. . . . where shrubs are palatable, goats are used to check shrub development (Harrington 1981:185).

Fire has other beneficial effects, used as a tool to reduce disease in trees (Hardison 1976:357; Groves 1986:140),[61] and in setting back the growth of unpalatable vegetation. Researchers demonstrated that ungulates avoid particular toxin-bearing trees such that these trees began to dominate the forest while depositing the greatest proportion of leaf to the litter. Toxins in the fallen leaves act to eliminate competitive undergrowth and thus radically reduce forage for ungulates (Bryant et al. 1987). The authors of this study propose that

> . . . periodic burning is a potentially useful control measure. Fire is often detrimental to chemically defended slowly growing species than more rapidly growing species . . . Fire also releases nutrients and opens the canopy thereby increasing the availability of resources required for rapid plant growth and regeneration of preferred rapidly growing woody plants. In short, initiation of succession by fire is an ecologically sound way to generate the type of vegetation preferred by browsing animals (Bryant et al. 1987:1015-16).[62]

The absence of toxin-bearing trees in the study area is noteworthy. When such trees disappeared (if in fact, they have altogether)[63] is a question which I shall pursue in future research as it may serve to indicate intensive forest management for grazing. *Pastori* do not eliminate trees other than for reasons of crowding, and to give preference to fruit-bearing trees. I observed that *pastori* regularly take axes with them to shape (trim) trees they wish to keep for shade and fruit, and select some for cutting when they are "not in the right place". Several also indicated wild pears in untilled, common grazing lands onto which they had grafted domesticated varieties.

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[60] Other rarer managerial burns are undertaken in specific forest locations to remove of dense vegetation where wolves are known to make their dens.

[61] In Basilicata and Apulia, olive groves are fumigated by burning cuttings to reduce illness -- possibly fungi (see Hardison 1976:373).

[62] One informant noted that acacias require periodic burning to stay healthy. Acacia seed are germination-enhanced through fire (Trabaud 1991:185).

[63] The various forestry scientists at the *Università degli Studi della Basilicata* with whom I spoke regarding the presence of toxin-bearing trees were not able to tell me positively whether such trees are present or not in Basilicata.

A San Cataldo informant responded to my questions about burning in the oak and beech forests that now dominate the area, that after trimming the trees and gathering deadwood for firewood during the winter (January and no later than March) the forest would be burned, thereby cleaning the forest, encouraging herbaceous growth and fertilizing with the ash.[64] "The forest was cleaned. In the forest grow also 'grasses' (*erbe*).[65] Fire aids the growth of these 'grasses,' the ash is like fertilizer." Throughout Basilicata, firewood gathered and cut towards mid-November until the end of December. Called *fascetti* referring to the bundles of sticks collected, a number of informants indicated that each year an area of *c.* 100 m was intensively cleaned, *fascetti* gathered, and then the litter was burned. Often *pastori* taking their flocks to graze the same copses (common lands) would arrange where and when they were going to burn, to insure that no one remained without pasture. Burning is undertaken in forests only on warm, dry winter days to clean and enhance the forest growth, from December through to March before plants begin to produce new growth.[66] Universally acknowledged was that burning produced fresh growth for grazing. A number of informants have noted that there was historically little need to burn because of the vastly greater number of animals (sheep, goats, cattle) whose grazing in forests greatly reduced an accumulation of undergrowth. Also indicated was that the daily traffic of these herds through the forest creates paths which act as barriers to the spreading of accidental fires (see also

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[64] Ash increases potassium, calcium, magnesium and phosphorus levels at the soil surface, which improves forage quality and palatability (Jones 1987:70-71). The black, post-burn surface also increases the ability of soils to absorb heat which promotes germination (ibid.:55). Similarly, Oechel et al. (1981:58) demonstrated increased productivity in grasslands following burning. Kutiel and Naveh (1987a; 1987b:21) also found rapid growth in herbaceous plants following nutrient release by burning, an effect carried over into the second season in this experimental trial in Israel. Their findings are parallelled in burning experiments in Spain (Merino and Vicente 1981:202). Rundel and Baker (1981:195) found that nitrogen and phosphorus levels after spring and autumn burns enhance growth in California grasslands. Nitrogen supply in semi-arid areas is as important to plant production as water availability (Noy-Meir and Kaplan 1978:166).

[65] 'Herbs', the Italian *erbe*, both in Italian and in the sense used by informants means all forage plants -- grasses, legumes and forbs, generally.

[66] See Mellars 1976 for American trials in forest burning showing improved herbaceous growth due to the removal of litter and fire-released nutrients

Acharya 1992:56 for goats creating fire breaks in dense forest).[67]

In the past, deadwood was collected on all property and trees were cut or trimmed for firewood. Now, deadwood is still collected, but the demand is less and the trees are less frequently cut for firewood. As one *pastore* observed, "now that the animals have diminished in numbers, lands are dirty, [they are] all spines" (*"mo i animali sono diminuiti cosi sono sporchi i terreni, tutte spine)"* (Cancellara, 84 year old mixed farmer). Another informant noted that if the woods were not cleaned with fire, "everything dies, even mushrooms don't grow (Cancellara, 82 year old mixed farmer)".[68] The consequences of fewer animals grazing and decreased demand for firewood for fuel is exceptionally damaging forest fires fuelled by accumulations of deadwood and litter in untended areas. Such damaging fires are often escaped stubble burns and occur during the peak dry season (July-August). *Pastori* acknowledge that even in forests they graze, they avoid the forest margins abutting fields before harvest. This creates a narrow strip of accumulated, overgrown brush which at the time of stubble burning can catch fire and carry it into the forest. Whereas in the past, the forest interiors were clean and therefore only carried fire under exceptional circumstances, their animals are now insufficient in number to eliminate fuel buildup. However, it is also true that the mosaic of arable, tilled land and untilled *saltus* and *silva* acts as an effective fire-break. Liacos (1973) acknowledges this in the Greek case: "The surface burnt and losses from wildfires would be much greater, if forests in this [lower Mediterranean] zone were not broken in relatively small stands by the interval of non-forested land" (Liacos 1973:70).

Other damaging, peak season forest fires are also set deliberately (see also Angioni 1989:234-235 for similar fires in Sardinia). Government workers spoke of fires set to burn reforested areas so that replanting would become necessary, a means of creating well-paying jobs for the local population. In an entirely different situation, one informant spoke of an on-going conflict with a farmer who resented the unsolicited grazing of cattle on his stubble fields. The personal disagreement has resulted in an annual "escaped" fire: the farmer burns his stubbles immediately after harvest, having made no effort to create a fire break between the stubbles[69] and adjoining open oak forest upon which the cattle herder grazes his cattle year-round. The fire inevitable escapes into the forest. Fortunately, combustible fuel is limited because of the high stocking rate on the pasture, and the fire does no long-term damage beyond temporarily removing pasture from grazing. Forestry officials report that such acts of vandalism are rare and occur typically between *pastori* with personal conflicts who burn the other's pasture out-of-season (the conflicts typically have nothing to do with grazing resources) (c.f. Koster 1977:184 for Greek herders practise of burning competitors' folds).

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[67] "There was no need to burn to clear these forests because the sheep and goats ate the undergrowth and thus kept it clean, reducing the fuels. There were as a result, fewer fires, and of these, very few were damaging. The woods were also intersected by *cautele*, broad paths where cattle, sheep and goats passed which acted as corridors that impeded fires from spreading rapidly and even spreading beyond the areas circumscribed by these paths" (paraphrased translation, Oppido Lucano, 80 year old agricultural worker, 27-06-94).

[68] Open oak forest, kept clean by grazing and burning, has greater biodiversity in flora and fauna (Naveh 1982c:136). Naveh (1974b:408) also remarks upon Classical Greco-Roman texts, the Talmud and Bible references to the use of fire, concluding that "[s]uch pastoral burning becomes part of the . . . multivariate anthropogenic biofunction in which burning was closely interwoven with grazing and cutting."

The role of sheep and goats as tools in forest pasture has been described above. However, cattle, pigs and horses also graze the forests and in some pastures, they dominate in numbers (see Appendix B). Cattle were more common 30 to 40 years ago. Seasonal, transhumant herds were brought in from the plains in the vicinity of Matera and the Murge of Apulia to graze in common grazing lands. Herders established long-standing agreements with the townships to graze their cattle on particular pastures.[70] Currently, the E.E.C. subsidy programs have undermined the traditional cattle industry which was based upon transhumant grazing of local biotypes of Podolian-breed cattle.[71] These cattle have been replaced by imported high milk or meat producers which are raised according to the industrial stall-fed (subsidized) program

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[69] Farmers must by law, plough under the stubbles at the edges of their fields before burning to avoid that the fire escapes. Most farmers will plough a narrow perimeter around their field, but note that the soils with stubbles interred are unproductive.

[70] See *Fida Pascolo* records (Tables and Charts in Appendix B) showing the minimum numbers of transhumant cattle arriving in the Tolve area.

[71] See Croce (1930:79) for his descriptions of "biotypes" (ecotypes), which vary greatly from one region to the next as they are bred for particular grazing resources.

(Matassino et al. 1987:21). Similarly, pigs grazed traditionally *allo stato brado*[72] have been replaced by industrial pig farms. Locals purchase piglets from these commercial producers and raise them for household consumption in pens on those small, privately owned plots of land dedicated also to olives, fruit trees, a vegetable garden and/or vineyard in the vicinity of the town, or on local farms in pig-pens. Horses are also much reduced in numbers, as are mules and donkeys. Mules tend to be stall-fed spontaneous hay and straw (wheat and barley). Typically, *pastori* own the few horses (more commonly mules) in the area which are grazed with the flock and are also stall-fed spontaneous hay (and limited barley and oat feed). Tractors have replaced these plough animals throughout Basilicata. Iannelli (personal communication)[73] noted that *Brachypodium pinnatum* (Gramineae) has become an infestant in the absence of horses grazing the *tratturi* (drove roads). To my knowledge, however, no study has been undertaken to document changes in vegetation resulting from the much reduced numbers and variety of grazing animals.

Pastori employed various strategies to avoid having to pay taxes for forest grazing on common lands. Many of the animals grazed in the forests are/were reportedly grazed there illegally (see Appendix B, *Fida Pascolo* records). If caught with more animals than registered (and paid for) in the municipal *fida pascolo* registers, informants reported that many *pastori* managed to avoid the fines or receive a reduced fine, by offering to the forestry official a lamb or kid, some cheese, "to fix the situation" (as a bribe). Some *pastori* wryly acknowledged that there were forestry officials who would accept the bribe and fine them nonetheless. Others chose also another (legal) method to avoid having to pay the full tax for grazing rights in the forests. Legally, *pastori* have the right to cross through forests to access private pasture (fallow) or a water source (paying only a minimal annual fee for the right of passage). Di Bérenger (1965:19) documents the antiquity of this 'necessary access right' in ancient Roman law.

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[72] Pigs were typically grazed during the summer months in oak forests along rivers. Grazed during the cool of night, these animals were taken onto stubble fields to consume fallen grain heads. One informant who had been a pig herder as a boy spoke of his social isolation. To my knowledge, pig herding *allo stato brado* is now rare. I am aware of only one pig herder who grazes a cross-bred (wild-domestic cross) herd of pigs in the oak and beech forests in the San Cataldo area. I was unable to arrange an interview.

[73] Professor at the *Istituto di Produzione Vegetale, Università degli Studi della Basilicata*, Potenza 14-03-1995.

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Pastori frequently arranged with a relative or *compadre* to rent fallow land or gain permission to graze stubbles whenever possible on the opposite side of a forest from another tract of land upon which they acquired or owned the right to graze their animals. Legally, they could then take their animals from one pasture to the next. The common strategy was to employ a great deal of time crossing from one side of the forest to the other, so that the animals were satiated more by their passage to and from the tracts of fallow land and stubbles, than by their grazing on the "target" property. This strategy is still popular today. Furthermore, the flocks transport seeds and disseminate them across the landscape during their movements from arable to forest, across a mosaic of vegetation (see Guillerm 1991:380).

Common grazing lands: sheep, goats cattle and pigs

Archival records of Tolve's common grazing land (*Fida Pascolo*) disclose a tradition of jointly grazing cattle and pigs on particular tracts of common land, while sheep and goats were grazed together on others. When I questioned informants about this separation, a variety of answers were supplied. Some claimed that cattle and ovicaprids cannot be grazed together because the cattle do not consume forage already grazed by sheep and goats. Apparently, sheep and goats tend to "dirty" the pasture for cattle by the way they trample the vegetation. Others claimed that cattle disrupted the grazing environment, fouling forage preferred by ovicaprids. Yet others argued that they could be grazed together if the animals were accustomed to shared grazing. An alternative explanation provided was that the cattle breed (Podolian) grazed in the common pastures *"allo stato brado"* are dangerous to sheep and goats, tending to charge, toss and/or gore other animals (including humans).[74] All informants agreed that the greater susceptibility of soils to compaction by the heavy cattle is mitigated at least in part, by the action of pigs performing soil aeration as they search out food.

The profusion of explanations proffered led me to seek out a specialist on Podolian breed cattle (Emilio Gambacorta, *Istituto Produzione Animali, Università degli Studi della Basilicata*). According to Gambacorta, cattle and sheep graze together.

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[74] The unreliable temperament of this breed was also proffered as an explanation by other informants for the fact that the herds of Podolian-cross cattle in the Tolve area are no longer milked despite the fact that the milk is used to produce a delicate and much sought-after cheese (*cacciocavallo)*. These animals are raised for meat.

They are not in direct competition for forage because they graze differentially, although there is considerable overlap in their grazing. Cattle require higher quality forage, whereas ovicaprids do well in "degraded" areas or on pastures already grazed by cattle (see also Croce 1930:97). The separation of cattle I witnessed, from all but pigs and the conflicting information provided can also be explained by the transhumant nature of cattle herds in the study area. Each cattle herder establishes a rental agreement to graze pastures seasonally. The high forage needs of cattle[75] and the monolithic nature of cattle herds results in their monopolizing pastures on a seasonal basis. This information is consonant with the *Fida Pascolo* records examined (Appendix B) and the information supplied by cattle herders. Over the last twenty years, the numbers of Podolian cattle grazed according to traditional practises have radically diminished in Basilicata. Most common grazing lands are still used by cattle herders, but the impact of these few animals on the grazing environment must be substantially different than in the past (a question for future research).

A further important consideration is the effect of pigs on vegetation. Pigs in forest habitats are effective soil scarifiers, performing "little ploughings", as one informant described it (see also Cappelli 1984:12; Iannelli 1986:138-139; also footnote 76, below). Where they find rodent caches of mast or succulent roots, they sometimes dig down 30 cm. Generally, they root along, turning over leaf litter, scarifying and aerating the soil surface. This produces excellent soil surface conditions for re-seeding, because where pigs have exposed the soil surface, seeds readily take hold. This clearing of the soil surface is also achieved by fire, the last step in "cleaning" the forest while aiding germination. In consuming large amounts of mast, pigs control oak density, helping to diminish growth from seed (see di Bérenger 1965:143; Hughes and Thirgood 1982:64).[76] Forestry officials consider pigs important tools for "weeding out" germinated acorns and oak saplings, performing a forest/pasture maintenance task (see also Brogi

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[75] Cattle require five times more forage than sheep (Wagner 1989:157).

[76] Pigs grazing in forests (beech, oak and chestnut) were noted separately under ancient Roman law, the forests identified as *silva fructifera* (Di Bérenger 1965). The separate consideration of pigs grazing mast in forests is parallelled in the modern instance in which herders grazing pigs in common forest pasture for mast were taxed separately under the *Fida Pascolo Ghiandifera* (see Appendix B). Di Bérenger (1965) also acknowledges the antiquity of use of pigs as tools to clean grazing lands by removing seedlings and suckers, and in tilling the soil (Pliny and Plutarch) (1965:448-449).

1984:37). Foraging pigs also serve to loosen the soil surface and mitigate soil compaction in areas grazed by heavy livestock.[77]

Stocking rates

Basilicata *pastori* supplement grazing with only the most necessary feed and hay, and these are typically provided only during lambing and suckling[78] (generally October - February) and on cold winter days when snow inhibits grazing. Discussed further below in the context of managing the arable (*ager*), most *pastori* also sow a mixture of barley (see also Benjamin 1992:98), vetch, and/or oats (and 'weed' seeds) in a field next to the fold to provide high quality winter forage for lactating ewes and dams, new lambs and kids, and weak sheep or goats. Limited feed provisioning prevails throughout the region.[79] *Pastori* explained that capital inputs were properly invested in cereal (particularly wheat) cultivation, and not in supplying costly feed to sheep and goats which could otherwise sustain themselves on "wild grasses" (for the most part on stubbles, fallow, intermittent grazing of cereals and forage crops, and on spontaneous growth in the untilled *macchia, gariga* and woods). Despite government initiatives to introduce "rationalized", industrial-style production of stock in the south (e.g. Bartolelli 1990:264-292; 444,470), this tradition remains. The reluctance encountered by agricultural extension workers to adopt the industrial system of low labour, high capital inputs is a reflection of this traditional allocation of resources to particular production goals. Close parallels with Indian strategies exist where "[g]oat management in India is based on the age-old concepts of the farmers that there should be 'zero inputs' in their management" (Chandra 1992:221; see also Cunningham 1982:348 for extensive sheep grazing systems; and Koster 1977:226 for the Greek example).

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[77] Ayora-Diaz (1993:88) notes that *pastori* in Sardinia consider pigs to be deleterious in pastures. This conflicting information may be attributable to the Sardinian practise of grazing pigs in common pastures along with sheep and goats, and not in forest grazing with cattle which is the prevailing practise in Basilicata.

[78] Ewes and nannies are selected not only for their milk production, but also for their ability to bear twins and even triplets. Ewes bearing twin and triplet lambs also produce greater quantities of milk which is desired by cheese producers. The ability to provide feed supplements to lactating ewes and nannies allows for the sustenance of the extra lambs and kids (see also Poyck 1962 for Iraqi example). Lambs tend to be removed (slaughtered) at less than three months, and ewes may lamb twice a year, but most *pastori* limit lambing to once during the winter, and produce cheese instead.

[79] Only one informant based production on the industrial stall-fed system. Even this informant grazed his flock on fallow and stubbles whenever possible. Furthermore, the use of paddocks which is typical of more intensive, industrial methods, is undertaken only by very small-scale producers who work full-time off the farm (paddocks were most common on city outskirts, next to commuters' homes, with a half dozen sheep kept for household use). None of those interviewed engaged in this apparently rare form of animal husbandry in the study area. Conversely, industrial-type, stall production of cattle have become the rule. Only Podolian-breed cattle are grazed on pastures *'allo stato brado'*, and these for the most part, under the transhumant system.

The problems of overstocking encountered in the Near East (Aboul-Naga 1987; Acharya-Bhattacharya 1992) highlight an important consequence of the traditional allocation of resources by *pastori* in Basilicata: that of the restrictions imposed on the number of head in a given flock by the annually occurring period of minimum pasture production and hence of the availability of forage resources for their flocks (see also Croce 1930:96). During these predictable periods of low forage availability, only those sheep and goats that can be sustained on the available pasture are maintained (Croce 1930:96; Cunningham 1982:331, 337; Hopkins 1985:248). This practise is consonant with Hocking et al.'s discussion of stocking rates in which "[a] flexible stocking rate is dependent on seasonal and annual variation in feed availability . . ." (1992:707), and also with Barker's (1981:23-24) observations that "a given area has to be undergrazed in winter in order to carry the stock through the summer" (see also Naveh 1982b:58). Such calculations of stocking rate are considered to be embedded in local knowledge, evident in Hocking et al.'s (1992:707) assertion that "[t]raditional herders probably already practice this strategy on intuitive information."

In the recent Near Eastern experience and unlike traditional practises which parallel those of Basilicatan *pastori* (see Noy-Meir and Seligman 1979:129-133), stocking rates are based on the maximum pasture production, augmenting with feed (hay, straw, grain) what little is available to be grazed during the minimum growth periods (Aboul-Naga 1987:860; Acharya and Bhattacharya 1992:183-184).[80] Consequently, grazing continues with an inflated number of animals year-round, especially during the period(s) of low pasture forage production. The result is inevitably degraded pasture. Conversely, in not depending upon significant feed and hay supplements, a limit is established which the Basilicata *pastori* tend not to exceed. The reasons expressed by *pastori* for placing such limitations on their flock size are economic. Exceeding the limit results in a loss of productivity in milk and meat, and a decline in flock health unless significant hay and feed supplements are supplied. In the context of traditional Greek pastoralism,

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[80] The problem of overstocking in pastures is also a result of increased lands being dedicated to mechanized arable farming at the expense of pastures (Schulz 1982:39).

> [v]illage herders may "push" a grazing area to its limits -- even overgrazing natural grass or scrub lands, but they will do so knowing that returns in dairy production will suffer as will long-term recovery of their pastures. . . . . such actions or tactics are . . . a short-term strategy (Chang 1992:77).

This is not to say that the number of individuals within a flock does not vary during the year,[81] nor that drought years do not radically change the ideal stocking rate.[82] However, *pastori* prefer not to dedicate capital and land resources to fodder and feed which would otherwise profit wheat cultivation (for those with arable land) as the capital outputs diminish profit from the flock. When droughts force the culling of animals, those remaining rapidly reproduce. In drought-prone western Pokot, straddling the Kenya-Uganda border, culling the majority of a flock is a common management strategy in response to drought-restricted forage (Dietz 1987:119).[83]

Pastori in Basilicata reported a loss of pasture productivity in recent years which they attribute to a reduced population of grazers. That the number of animals over the last four decades has decreased dramatically in the Region of Basilicata is borne out by government censuses. For example, in the table below are contrasted the numbers reported for 1950 and 1990 for one township in the study area.[84]

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[81] The greatest proportion of lambs are sold, while old, unproductive individuals are slaughtered, and reproduction is strictly controlled for seasonal and market fluctuations.

[82] Apulian informants had just passed through a long drought period from September (1994) until January (1995) and had lost a number of head (one lost almost 15% of his flock). The remaining animals had survived the winter on olive cuttings. Apparently in the past, when pasture was inadequate and the season showed no signs of improving, old and weak animals were culled from the herd and their meat sold (see also Saville 1981:344-345). Now there is no longer any market for their meat so they pull as much of the flock through as possible, but weaker ones perish. The EEC subsidies now make it economically wiser for the *pastore* to try to pull through the whole flock, and be compensated for loss (mortality), than to provide expensive feed.

[83] Another factor favouring rapid rebuilding of ovicaprid flocks is "their short reproductive cycle [which] coincides more or less with the green season . . ." (de Wit and Seligman 1992:2).

Table 7: Animals recorded for Ruoti township.

Year	Ovicaprids	Cattle	Pigs	Horses
1950	3698	374	686	471
1990	2214	994	784	57

While it is difficult to draw conclusions from the table data, the drop in the number of ovicaprids is clear, as it is for horses.[85] More persuasive than these statistics is the unanimity of informants in their accounts of the present paucity of grazing animals when compared with those grazing the same lands and forests in the past.

The sharp decrease in the numbers of animals is reported to have begun in the 1950s, both in terms of transhumant flocks, and those pastured year-round in the Tolve area. Before 1950, I was told approximately 2000 bovines and over 15,000 ovicaprids were in the Tolve Comune. Now only 15-20% remain (estimated between 500-700 bovines and 2000 ovicaprids). All informants viewed the diminished numbers of grazing animals as a central factor in the drop in forest productivity (see also Morley 1981:381; Rackham 1983). Informants indicated that "before" there were many more animals pasturing these lands, whereas now the herbage production in these woods barely supports their flocks. This suggested to me an interrelationship between herbage production and the presence of grazing animals. More specifically, that the flora is dependent upon grazing (tillering of plants and trees), the passage of animals and scarification of the soil, fertilizing through their manure (Noy-Meir et al. 1989) (also enhancing digested seed germination), setting seed in soil, and keeping the forest "open" for optimal production. The sharp decrease in the numbers of animals over the last 30 years (the numbers continue to decrease) that continue to pasture *'allo stato brado'* has certainly contributed to the drop in forest productivity. *Pastori*'s observations of the relationship between animals and the productivity of grazed flora is supported by research reported in the literature (e.g. Noy-Meir et al. 1989; Noy-Meir 1992).

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[84] From Salinardi (1973:146). 1990 statistics are taken from the government agricultural census (ISTAT 1990-1991:173, 175) which, I have been told is only ca. 65% accurate, and the numbers are probably inflated to take advantage of subsidies (c.f. Vargas-Cetina 1993 for a description of the same in Sardinia). The large number of cattle in the Ruoti area supply the mozzarella industry in Ruoti. These are not pastured under the traditional system, but are managed under stall-fed, industrial-type production systems through Common Market subsidy and incentive programs.

[85] During the 1950s, only few cattle and horses were kept in stalls, and these were reserved for animal traction, the others were taken out to pasture -- generally tethered (Salinardi 1973). According to the local informants, pigs in this area comprise animals either kept on forest pasture (relatively few, as grazing pigs *allo stato brado* has become rare) or kept by households in villages, at the edge of town, or on farms in pig pens. There are also a few industrial pig farms in Basilicata, however. The dramatic increase in the number of cattle reflects the influence of the EEC subsidy program and the growth of the local cheese industry for which milk is purchased from local producers as well as goat- and *pastori* as far away as Tolve.

As noted above, all *pastori* interviewed complained of a loss of pasture productivity, attributing it to the diminished number of animals grazing the forests, *macchia* and *gariga*. The interrelationship between the need to burn and insufficient animals was stressed by Basilicatan *pastori*. Iannelli (1989:81) describes a contributing factor causing this phenomenon, noting that under too low stocking rates the animals will select only the most favoured species, allowing those less palatable plants to set seed sooner and thereby gain a competitive advantage (see also Bullitta et al. 1993:68). However, where stocking rates are low, fire is typically used both to control the populations of less palatable plants and to encourage the germination of seeds and fresh regrowth among favoured species. Accepting that fire is both selective agent and aids germination (particularly of hardseeded legumes), the data show ovicaprid grazing (and therefore digestion and excretion) and the use of fire to be interrelated. Where ovicaprid grazing pressure is high, fire is little used. The animals "clean" the pasture themselves and in grazing, stimulate plant growth.[86] Fire therefore functions to enhance seed germination and "clean" the vegetation where ovicaprids are insufficient in numbers both to keep up with the growth and to consume a high proportion of the seeds; this in turn acts to insure germination.

Consequently, controlled grazing of ovicaprids (which are the predominant grazing animals in Basilicata) and to a lesser extent, other grazers, and management through selective cutting and burning, have acted in tandem to shape pasture plant composition. Certain plants have been selected for their palatability and for their capacity to respond with their own mechanisms to these pressures, thereby enhancing their reproductive success. Where sheep and goats are abundant, they act as selective and propagative tools, enhancing at the same time, their own forage base. Where they are not abundant, selective cutting and controlled burning replaces their function and similarly improves the pasture. This complementarity between plant community composition (palatability), productivity (stocking rates) and its management with fire is a widely acknowledged pasture management strategy in semi-arid zones (Wilson 1982:327; Kuhnholtz-Lordat 1939:199-201).

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[86] The inverse relationship between grazing intensity and need to burn to clean and enhance pasture productivity is found in widely disparate environments such as in the Philippines among the Hanunóo (Conklin 1957:60-61).

CHAPTER 6

CROPLAND MANAGEMENT: THE *AGER*

> The [South Italian] farmer finds in livestock not only a source of profit, but the best way to confront the frequent bad years; because without compromising the future of a flock, it is always possible when necessary, to reduce the livestock capital within certain limits, reaching equilibrium with the returns from their sale . . . . This capacity of livestock to support agriculture is most manifest and most useful in farming in the continental Mezzogiorno, where agricultural production oscillates between distant extremes (Croce 1930:154, my translation).

> Sheep and goats are interesting [in] . . . the manner in which they can be used, their potential for making mixed farming more stable and efficient, and their ability to act as a shock absorber in times of hardship . . . These animals have many advantages over the larger livestock; they breed at an earlier age, and more quickly, and so are easier to replace; they have a marked tolerance of the droughts which are a perennial feature of Iberian climates; and they provide milk, manure, and the ability to tread a seed bed to a fine tilth (Harrison 1985:92-93).

In the foregoing section I described the integral role of sheep and goats in maintaining pasture productivity. Basilicata *pastori* view their flocks as tools, partners in cultivating and managing pasture. Detailed below, farmers equally value ovicaprid flocks in managing their arable land. The relationships between herding and farming are obscured if viewed as separate production units and according to property boundaries: household property is no measure of a *pastore*'s range, and the absence of fences which would obstruct passage across the landscape is but one index of the exchange of resources between the two production systems. Elevation-defined vegetation zones, the patchwork of fallow and sown lands, common grazing lands, and dispersed, "fragmented" property, sets up physical conditions (in part based upon topographical heterogeneity) which encourage rather than impede the integration of farming with pastoralism.

Like the foregoing chapter, this chapter consists of an analysis of the Basilicata data from Chapter 4 with reference to technical reports and parallel strategies elsewhere. In particular, I discuss below Basilicata farmers' strategies in managing the arable and how the arable is integrated with herding strategies. The analysis that follows is concerned with technological practises and agro-ecological relationships, rather than the social, economic, or political context in which they occur. Whereas the distinctions between land-poor and propertied are significant, the focus is on the technological strategies employed and consequent biological relationships.

Comparisons are made with the South Australian agro-pastoral systemic relations which involve cereals sown in a two year rotation with forage legumes and integrated cereal and livestock production (e.g. Webber 1990). The Australian data and its analysis largely derives from fieldwork undertaken by Henry T. Lewis in 1990 and 1992 (Lewis and Boag n.d.). Comparisons are also made with agro-pastoral practises in southern Greece illustrated largely through the work of Forbes (1982) and Koster (1977), plus other examples from the Mediterranean Basin, and other semi-arid, mediterranean climate regions.

Crop Rotations

Throughout Basilicata, the fallow is broadly conceived as a rest period following cereal cultivation, and is the most variable element of the crop rotation. The various types of fallow employed (whether a fallow of legumes sown as green manure, a mixed hay fallow, a perennial legume forage and hay crop, grain legumes sown for human consumption, for supplementary chicken and pig feed, or for sale as seed, or a "bare", "weedy" fallow) all have in common a legume constituent, the cultivation of which is a recognized means of enhancing soil fertility.

The Basilicatan "bare" fallow is included as a leguminous fallow because of the prevalence of spontaneous legumes (particularly before the advent of deep ploughing) which may or may not be augmented by broadcast sown clovers. Valued forage emergent in "bare" fallow includes self-regenerating forage legumes such as medicks and clovers which survive well in rotation with cereals (e.g. Cocks 1988:6-7), and are adapted to the particular system of grazing and crop rotations (Cocks 1985:105-106). Also considered is the role played by flocks in sowing favoured forage in fields via their manure, thereby augmenting and replenishing spontaneous forage legume seed in the soil seed bank (see Appendix E, Preliminary Results of Ovicaprid Faecal Pellet Seed Content Analysis).

Described in depth in Chapter 4, crop rotations in Basilicata ideally follow a three year rotation of wheat, followed by barley or oats, followed by a fallow year. Nonetheless, rotations vary within a single agricultural year on the same farm and between farms on the basis of soils, numbers of livestock, and amount of available arable land. The three year crop rotation is practised throughout the Mediterranean where soil fertility permits. However, a two year rotation is most common, comprising a year of cereals, followed by a fallow year, in which the fallow frequently takes the form of legume crops, or "bare" fallow, grazed by ovicaprid flocks.

Other ethnographic examples of such rotations abound. For example, documented also in the Province of Potenza (Basilicata) is ". . . a simple crop rotation plan inherited from antiquity" of wheat followed by legumes cultivated for forage (Banfield 1958:50). Chapman (1971:18) too describes in Sicily (1928) a rotation of wheat and legumes (predominantly fava beans for food and feed), and the cultivation of oats, barley and hay for fodder and feed. Other parallel crop rotations are described for the peninsula of Methana (eastern Peleponnese, Greece) as "exceedingly complex" (Forbes 1982:221), but similarly grounded in a two year crop rotation of cereal followed by fallow. Wheat dominates cereal cultivation in the Methana example (as it does in Basilicata), with oats and barley playing lesser roles in terms of surface area. Like Basilicata, oats and barley are important Methana crops cultivated for hay, seed (as feed) and for green grazing (ibid.:221-222). A "bare" fallow is also used on Methana where other leguminous fallows dominate and, as in Basilicata, vetch is a favoured fallow crop, consumed by humans only during periods of famine (ibid.:419).[1] Other legumes, presumably harvested for their seed are fava beans and chick peas, in addition to a ". . . leguminous crop normally used for green fodder called '*lathouri*'," (ibid.:223), possibly chickling vetch (*Lathyrus* sp.).

> The two field system on Methana is therefore not simply a simple arable-fallow system, but one in which legumes are rotated with cereals . . . . The legumes help to replace nitrogen in the soil for use by the following cereal crop. The alternation of very different kinds of plants also reduces the risk of a build up of pests and diseases. Those areas which are not cultivated but are left fallow provide an important resource in the form of grazing, especially in early winter when there is little for the stock to eat and the pattern of grazing must be very extensive (Forbes 1982:223).

Two year rotations are also identified for the 15th to 14th centuries B.C. in the Near East on the basis of textual evidence describing a mosaic of fallow and tilled lands, of pasture and arable (Zaccagnini 1979:21, 31, 35, 103-105). A biennial rotation of fallow and cereal is documented for Iraq during the 1950s (Poyck 1962:26), and a similar system appears to have prevailed in Iron Age Israel (construed from interpreted texts) where both ancient and modern agricultural calendars (Borowski 1987:47, 34, 37) parallel that of Basilicata (see also Hopkins 1985:197-202).

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[1] Fodder legumes cultivated in Greece are the same as those cultivated in Basilicata (see Podimatas 1990:63 for a list).

In their discussion of traditional agriculture and pastoralism in the semi-arid Negev,[2] southern Israel, Noy-Meir and Seligman (1979) describe a technologies and biological elements which are strikingly similar to those of Basilicata. The crop rotation they identify is also a two year rotation of cereals. Primarily wheat is cultivated, but also barley followed by year of tilled fallow, or less commonly, cereals are grown in rotation with grain legumes (lentils and vetches) (Noy-Meir and Seligman 1979:127).

Traditional crop rotations in Turkey also involve a year of wheat or barley followed by a "bare" fallow, vetch or food (chickpea and lentil) legume fallow (Durutan et al. 1990:242), whereas Egyptian farming is reported to have been dominated in the past by a rotation of wheat with clover, the clover providing forage and augmenting soil fertility (Clawson et al. 1971:30), corresponding to South Australian ley farming. The same authors report:

> Systemic rotations are not rigidly followed in Syria. But a practice of one or more years of fallow is generally observed. A characteristic three-year rotation in the higher rainfall wheat growing areas is a year of wheat or barley followed by a year of chickpeas or lentils. The third year is fallow -- that is, no crop is planted. At this point it should be emphasized that in Syria, as well as in most of the Middle East, a year of fallow means a year of weeds that are grazed by sheep or goats (Clawson et al. 1971:35).

Clearly, there is a consistency of practise around the Mediterranean Basin, the rotations all combine cereal crops with leguminous fallows. Because the spontaneous flora present in Basilicata is found throughout the Mediterranean Basin (Kernick 1978), and spontaneous legumes are a dominant component of plant communities in grazed lands, "bare" fallows in these other illustrations are also included as leguminous fallows.

Experimental trials in semi-arid Syria have demonstrated the value of cereals grown in rotation with pasture legumes, which further suggest that the effect of preceding legumes on the subsequent cereal crop " . . . has more to do with increased nitrogen availability than with water storage" (Cocks 1988:4-5; also Noy-Meir and Harpaz 1978:166). Regardless of the form of fallow employed, the role within the crop rotation remains the same: to enhance soil fertility and provide a break from cereal cropping. The objectives of rotating annual crops and fallow in semi-arid environments as stated by Isom and Worker (1979) are:

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[2] Noy-Meir and Seligman argue that the system they describe has persisted from the Chalcolithic (*c.* 3500 B.C.) to the present (1979:124). Their data are derived from Biblical, Talmudic, and other religious and legal texts (the Mishna, in particular) in addition to archaeological data, travellers' accounts, modern farming systems studies and their personal observations.

> (1) to conserve moisture and nutrients and make them more available to the crop, (2) to control weeds and minimize losses from weeds, insects, and diseases, and (3) to expedite seedbed preparation for the crop which follows the fallow (Isom and Worker 1979:202).

Whereas the trend in farming development programs urges the introduction of a purportedly new farming methods and crops into semi-arid areas (namely South Australian ley farming), the traditional practises -- the technological strategies and biological elements of Basilicatan farming and herding are congruent both with the objectives set out by Isom and Worker (1979, above) and Australian ley farming. In fact, the analysis of the Basilicatan systemic relations presented below reveals close parallels between the two.

> The concept of ley farming is to replace the weeds in weedy fallow with pasture legumes . . . . Any legume can be used provided, like a weed, it has the ability to persist without re-seeding. Because they produce 'hard' seeds (which are not permeable to water) many wild Mediterranean legumes have this capacity, and it is common to see such species as *Coronilla scorpioides*, *Scorpiurus muricatus* and *Medicago polymorpha* in the weed flora of fallows. The concept of a 'seed bank' containing hard seeds of the pasture legumes, is central to the use of self-regenerating pastures (ICARDA 1987:12-13).

According to Basilicatan informants, the seed bank is more than a "concept", but is a "natural" characteristic, inseparable from the soil itself ("the children of the soil" -- *"figli della terra"*). The soil seed bank in arable lands is managed by prescribed burning of stubbles, traditional cultivation techniques and controlled grazing. The spontaneous flora is simultaneously introduced, managed (and at times augmented by top seeding), maintained, and exploited by ovicaprid flocks.

Basilicatan farmers identified crop rotations as instrumental in controlling persistent, unwanted, spontaneous flora, particularly wild oats, when it grows in competition with wheat. The methods employed combine grazing with crop rotation -- especially cereals followed by a hay fallow (see also Isom and Worker 1979:202). For instance, where fields are infested with wild oats, mixed-farmers report sowing those fields to several consecutive years of hay.[3] In less extreme circumstances sheep and goats serve to control growth in stubbles and in fallows -- their grazing limits ability of plants to set seed. Regardless of the rotation employed and the crop sown, sheep and goats are integrated in the rotation, albeit for varying periods at diverse times of the year. Grazing growing (green) cereals in the winter to early spring, fallow fields year-round, and stubbles post-harvest and pre-sowing, sheep and goats are used as tools throughout the agricultural calendar.

Finally, staggered sowing and field fragmentation (dispersed fields across the vertical gradient) are acknowledged means of reducing risk in the drought and frost-prone highlands of Israel, as well as reducing extra-household labour requirements by distributing labour demands in sowing and harvesting over a broader period (Hopkins 1985:215-217). Similar conclusions appear for southern Greece where harvest results are shown to vary according to micro-environment (Koster 1977:341-342; Forbes 1982:415; see also Galt 1979).[4] With reference to grazers, fields scattered across the vertical gradient are cultivated at different times so that stubbles and crops become available for grazing over an extended period (see Chapter 4).

The Technology of Burning

Described with reference to pastoral technologies in the foregoing chapter, burning is undertaken throughout the year in different zones to achieve different ends, and is executed by different producers. For farmers, burning marks both the end and beginning of the agricultural year and, in the context of farming, is restricted to burning cereal stubbles (see Forbes 1982:235-236, for s. Greece parallel). Stubble burning is undertaken in late summer, ideally when fields are dry and before significant spontaneous growth has emerged. Government agricultural workers and agronomists in Italy share a predominantly negative view of burning, largely on the grounds that burning is believed to promote soil erosion and reduce valuable soil humus in drought-prone areas and clay soils. As in other semi-arid areas (e.g. South Australia), and despite the negative representations by agronomists to farmers, post-harvest burning remains an almost universal practise. A few (less than 10% in the Basilicata study area) have followed the agronomists' recommendations and have halted their burning. These few individuals are those with the mechanical means and capital necessary to reduce the large clods of soil to form a more uniform seed bed. Otherwise, serious problems arise from incompletely broken down stubbles in the absence of fire.

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[3] In cutting hay, plants are removed before they develop seed, catching most of the early-maturing oats. If also grazed during growth, the early maturing wild oats are held back so they stand little chance of setting seed before being cut for hay.

[4] Field fragmentation and risk mitigation appear also in Banfield's ethnography (1958) of "Montegrano" in the Province of Potenza, Basilicata. "Although it is a time-consuming activity and tiring task to walk from one field to another, most farmers prefer to have their land in at least two pieces as insurance against crop failure; the hailstorm which strikes one side of the mountain will leave the other untouched" (Banfield 1958:51).

Basilicata farmers maintain that the primary reason for stubble burning is to facilitate ploughing. They emphasized further that eliminating crop stubbles is essential to the success of the following crop; if stubbles are not burned, large clods of stubble and earth remain. Ploughing under of intact stubbles subjects the following crop and particularly newly germinated seed to increased susceptibility to frost and drought because of gaps created in the soils by residual stubbles.[5] For example, farmers maintained that where they ploughed a fire break around their fields prior to burning stubbles, crops did not germinate or if seed germinated successfully, the plant failed to grow properly.[6]

Burning stubbles is documented in southern Greece by Forbes (1982:236), who refers to it as "field clearing" but limits discussion to describing how Greek government policy at the time of the study prohibited the use of fire except after the first autumn rains -- at which point burns are largely ineffectual. Although Forbes (1982) does not investigate the reasons for burning, the phrase "field clearing" suggests that the primary aim of stubble burning like that expressed by Basilicatans, is to facilitate ploughing. Liacos (1973:72) also defines stubble burning as a universal management tool for increasing productivity, for easing ploughing and helping to prepare a better seed bed.

> Wheat farmers almost all over Greece consider stubble burning a good technique for increasing wheat production. . . . They practice it because they strongly believe in its beneficial effects in spite of the general belief that burning is harmful, especially to the soil (Liacos 1973:72).

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[5] I observed partially burned stubbles that had been re-exposed by ploughing after five years (the EEC set-aside fallow program): the stubbles had not broken down whatsoever.

[6] Chatterton and Chatterton (1989:51) also note that intact stubbles inhibit medick germination. In arid and semi-arid areas fire is a necessary tool for eliminating this thatch, and to hasten the decomposition of plant material (Jones 1987:20).

Besides helping to reduce stubbles to facilitate ploughing and preparing a good seed bed, Basilicatans also noted collateral benefits to burning, among which is enhanced soil fertility, evinced also by farmers throughout Greece (Liacos 1973, above), and is noted in passing by Brögger (1971:41-42) for Calabria. In transforming stubbles into ash, burning releases minerals trapped in the dry plant matter, which can then be readily absorbed by the subsequent crop. Ploughing immediately after burning is considered ideal, but many Basilicatans indicated that they now rarely undertake this practise. They explained that the precocious completion of harvesting and threshing because of the introduction of combine harvesters, and the reduced number of animals to hold back spontaneous growth in stubble fields now makes ploughing directly after burning impractical, because stubbles must be burned sooner in the season and well ahead of seed bed preparation. Early burning of stubbles is undertaken to avoid ineffectual burns that result from too much green (spontaneous) growth emerging which has not been knocked back by grazers. Furthermore, the introduction of artificial fertilizers has also diminished the need for incorporating the ash as fertilizer.

Stubble burning appears to have been an ancient practise in the Mediterranean region. The use of fire as a tool is well-attested by all of the Classical agronomists. Xenophon refers to the beneficial effects of the practice of burning stubble and Vassus notes its use in reducing crop pests and as a fertilizer (Liacos 1973:69-70). With reference to Roman Italy, the scheduled appearance of stubble burning in the Roman farm calendars indicates that this was standard practice (White 1970:194-195; Kolendo 1980:115-116; Spurr 1986:64). Other examples of the antiquity of stubble burning can be traced to the early Iron Age:

> Semple (1931:407) and Dalman (1932, 2:141)[7] report that it was a common practice to burn stubble in the fields and thus provide an ash fertilizer. The Book of the Covenant contains a precept (Exod. 22.6)[8] which most likely has in view the use of fire as a tool in the fields . . . (Hopkins 1985:207).

Analogous modern practises occur in the Negev of southern Israel, where stubble burning is part of the traditional farming practises, also primarily undertaken to facilitate ploughing, and is combined with grazing (Noy-Meir and Seligman 1979:128). Parallel strategies are documented in traditional Iraqi farming as a method of clearing fields (Poyck 1962:45).

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[7] Gustav H. Dalman. 1932-35. Arbeit und Sitte in Palästina. Vols. 2-4. Gütersloh: C. Bertelsmann.

[8] "When fire breaks out and catches in thorns so that the stacked grain or the standing grain or the field is consumed, he that kindled the fire shall make full restitution" (Exodus 22.6).

Burning was not typically identified as a means of reducing crop pests, although a few Basilicata farmers maintained that pest reduction is another collateral benefit of burning stubbles. Liacos (1973:74) also makes reference to a reduction of crop pests and disease following upon burning stubbles. Most typically, informants responded to questions regarding the consequences of not burning, that they had always burned and therefore did not have any experience of not burning with which to compare (e.g. Cancellara, 78 year old mixed farmer).

Despite the insistence on facilitation of ploughing as the primary reason for burning stubbles, informants universally maintained that burning also served to induce germination of spontaneous forage. Informants repeatedly emphasized the beneficial effects of fire in promoting germination and fresh regrowth of plants, providing high quality, tender forage for grazing animals, while simultaneously controlling plants avoided by grazers. Their observations are supported in the botanical literature.

> Germination of seeds in the seed bank is stimulated by fire. . . . Infertile soils become much more fertile after fire because of the so-called 'ash-bed effect' . . . This increased fertility, together with reduced competition from established plants, soil micro-organisms and soil fauna, appears to favour germination and establishment (Specht and Clifford 1991:199; see also Rasmussen and Rohde 1988:940).

Lewis (Lewis and Boag n.d.) also records in the words of a retired farmer, the integration of burning stubbles and the use of sheep as tools in South Australia:

> After burning the [cereal] stubble, you'd run sheep onto it to help mix the ash with the soil . . . to help break it up. When the pasture began to green up, we'd put the sheep onto the paddocks to feed on the weeds and volunteers [spontaneous growth of barley and wheat]. . . . Without the sheep to check [the growth of] weeds you won't have much of a medic pasture and not much of a cereal crop [the next year] either.

Stubble burning does set back "weeds", and hence reduces the amount of tillage necessary pre-sowing. It also encourages the growth of more tender forbs including the germination of spontaneous legumes and seed fallen during the harvest, providing an important grazing resource during lean growth periods.

Jordan and Shaner (1979:276) view burning as an ineffectual method for controlling "weeds" because burns occur after seeds have been disseminated, and yet they acknowledge that grazing serves to control the majority of emergent spontaneous ("weed") growth, suppressing seeding (ibid.:278). Basilicatan mixed farmers do not seek to destroy the "weeds" emergent in their fields, but to exploit them as forage, and where especially valued forage emerges, work to protect and harvest this spontaneous growth for hay. While it is true that the less palatable and unpalatable "weed" species are not grazed (e.g. *Xanthium* sp.), these are controlled by the stubble burn. If they emerge later in the season and become a problem for livestock, they are cut and burned *in situ*. In short, Basilicatans maintain that burning stubbles is a means of cleaning and fertilizing fields, of helping to prepare for ploughing, is a catalyst for initiating plant germination, reducing crop insect infestants, of softening the soil and controlling unwanted plants that emerge in the arable.

Changes over the last two decades have also had an impact on stubble burning and crop harvesting. With reference to burning stubbles, informants maintained that larger field size has decreased control over stubble burns. Large wheat fields in the environs of Irsina especially occasioned such comments, informants pointing out that the use of tractors and combines allows larger fields to be cultivated than in the past, and further, they allow for rapid harvesting. Traditionally, harvests took longer to complete, fields were smaller, and the patchwork of crops and fallow formed a mosaic across which it was more difficult for fires to escape.

Problems now associated with stubble burning arise largely from escaped fires blamed on carelessness and the reduced numbers of livestock grazing untilled areas. Informants including forestry officials noted that farmers are compelled by law to plough around the boundaries of their fields before burning stubbles as a mechanism for containing the fire. Farmers, however, indicated that crops sown within the ploughed strip failed to germinate or develop properly. Consequently, most do not create a fire break, or plough only a narrow tract less than half the width of that required by law. Noted above, informants across the territory further maintained that traditionally sheep and goats kept stubble lands clean of spontaneous growth and reduced the amount of stubbles remaining in the field. Where stubble fields are no longer grazed because of decreased numbers of livestock, emergent spontaneous growth is no longer held back, forcing early burning of stubbles.

An additional observation voiced by informants regarding changes in stubble burning is that fields now tend not to burn evenly because combines leave a row of chaff and straw in their wake which burns rapidly along the row of chaff and straw, but does not spread evenly across the field. Finally, the practise of drawing a toothed harrow (*erpice* in Italian, *"u cimicium"* in the dialect) though the stubbles before burning to insure an even burn (Oppido Lucano, 74 year old farmer), appears to have fallen into disuse.

Other difficulties in burning stubbles arise particularly where fields are contiguous with forests. Commented upon in Chapter 5, the replacement of wood fuel with fossil fuels for household use, the lower density of grazing animals and the care taken by *pastori* to keep their flocks from entering others' sown fields, has resulted in a buildup of dry fuel along forest margins and greater fuel buildup in the forest litter. Stubble burns easily escape into these areas.

Legume stubbles are not burned. Informants universally ridiculed the suggestion that such stubbles be burned because of the loss of soil nitrogen to the following crop. Rather, after having been thoroughly grazed, these legume stubbles are disced in and incorporated into the soils. The succeeding cereal crop stubbles, however, are burned and the volunteer legumes which emerged during the growth of the cereal crop are simultaneously burned, mature plants having already set their seed. The seed set by the new growth, and a proportion of that already present in the soil seed bank germinates following burning of the cereal stubbles.

Grazing the Arable

> The traditional agro-pastoral systems were practiced by both sedentary villagers and nomadic Bedouin in the semi-arid regions of the Middle East for about 5,000 years with little change until the 1950's. In this system, mixed flocks of sheep and goats are maintained for most of the year by grazing common rangeland, non-cultivable hillsides and fallows. In summer the stubble of the grain fields is also grazed and in drought years feed shortages are buffered by grazing the crop itself and by increased migration of the flock (de Wit and Seligman 1992:3).

> The practice of keeping sheep on arable land is widespread throughout the major sheep producing countries. . . . the reasons for having sheep are as follows: either to graze a forage crop *in situ* to supplement of replace pasture when it is in short supply (e.g. during drought or in the winter) and enhance soil fertility at the same time, or to consume crop residues and weeds and add fertilizer (Newton 1982:377).

> Sheep are the best and cheapest workers we've got. They weed the fields, they

> loosen up the soil, they add fertilizer, they compact the soil after the barley's planted, and they mow it for you if it starts to grow too soon -- all this plus the wool and meat we get from them (Lewis interview of Yorke Peninsula retired farmer, South Australia, Lewis and Boag n.d.).

A central factor in maintaining the farmer-*pastore* relationship is the timing of grazing arable land. Arable fields are accessible for grazing during periods of low forage production in untilled areas. Summer grazing of stubbles and fallow occurs during the height of aridity when pasture production is at its lowest. Also, farmers' needs to have growing cereals grazed in winter, coincides with the winter near-stasis in vegetation growth (Iannelli 1986:128), a period of stress for ewes and does which have increased nutritional needs because they have birthed their young and are lactating. The complementary timing of farmers' needs to have their fields grazed, and flock requirements for supplementary grazing, is but one facet of the complex relationships between the two. The complexities of the relationship emerge in the scheduled use of sheep and goats as tools in managing arable lands. For instance, they serve to maintain agricultural productivity through their consumption of post-harvest stubbles and the spontaneous growth emerging both before and after the stubbles are burned. Their role however, is much more extensive than this alone suggests.

Grazing stubbles and "bare" fallow

Herds play an integral role in controlling post-harvest growth in stubbles. While grazing ("knocking back") green growth, thereby reducing that which impedes a good stubble burn and inhibiting it from sowing seed, they concurrently deposit manure, their hooves help to break up stubbles and scarify the soil surface; all important roles in managing the arable. The relationship between herding and farming is symbiotic because stubbles become available to flocks during the arid summer period of minimal pasture production, and the spontaneous growth and crop residues provide an important forage resource for grazers. Discussed further below, the ways in which spontaneous growth is simultaneously disseminated (sown) and managed through grazing is central to sustaining the interrelationship.

"Stubble grazing" implies that the primary forage in post-harvest fields is the stubble itself. Although stubbles are consumed, also grazed are crop residues such as fallen grain heads or legume pods, spontaneous growth from these and "weed" seeds during the period before and after stubble burning. Following stubble burning, additional seeds germinate and the growth momentarily set back by the burn together comprise the forage available to grazing ruminants until ploughing and harrowing preparations for sowing.[9] Thus, stubble grazing is to be understood more broadly as the grazing of not only crop residues, but also of all that spontaneous growth which occurs both before and after the stubbles are burned: in essence all plant material present during the period between harvest and ploughing for the following crop (or for fallow in some, but not all instances).

Stubble grazing appears to be a universal contemporary and historic practise in semi-arid areas where livestock are present. According to an interpretation of Iron Age texts, ancient Israeli farmers left abundant stubbles for grazing by livestock (Borowski 1987:59-60), an interpretation also supported by Hopkins (1985) who moreover argues for the grazing of fallow fields in Iron Age Israel.

> Grazing of fallow fields not only deposited manure but also served the purpose of eradicating weeds. Grazing on harvested fields permitted animals to feed on the stubble at a time when the beginning of the dry season had faded the greens of other pastures (Hopkins 1985:207).

Noy-Meir and Seligman (1979:128, 132) also document stubble grazing which they view as part of a long-standing traditional system dating from the Chalcolithic (*c.* 3500 B.C.) to the present in the Negev (see also Noy-Meir and Harpaz 1978:144; see also Benjamin for current practises). In the semi-arid area of western Pokot (Kenya-Uganda border), pastoralists are permitted to graze stubbles "without constraint" (Dietz 1987:109n), suggesting that similar interdependencies exist between herding and farming in this area. With reference to the symbiotic relationship in western Pokot between pastoralists and farmers, Deitz (1987) remarks:

> If we follow Ruthenberg's classification (1971) 'fallow' is in fact unregulated ley. On the one hand part of the plant nutrients are eaten by the livestock; on the other hand there is some natural fertilizing of the soil (Dietz 1987:109n).

Also in eastern Libya, pastoralism and agriculture are interlaced in the Bedouin system, a relationship described as "mutually supportive and interdependent", and "symbiotic" (Behnke 1980:47), in which the grazing of stubbles is an integral and integrating component (ibid.:47, 54).[10]

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[9] A technique advocated for minimizing soil erosion in semi-arid environments is to avoid ploughing stubbles until the field is to be sown (Henderson 1979:235). This may well be another benefit of grazing and burning stubbles which help to maintain a field in condition that it may be ploughed. However, this aspect was not investigated, nor was it noted by Basilicatan farmers.

The grazing of flocks on both fallow and stubbles is considered characteristic of Mediterranean semi-arid herding systems (Narjisse et al. 1991:232). Among the Roman agronomists, Varro[11] (1.53; 2.2.12) makes reference to grazing sheep on post-harvest stubble, as does Columella[12] (7.2.3; 7.3.9; 7.3.19; 2.14.9) who emphasizes their role in weeding and fertilizing as they consume edible weed and grass growth, suggesting that this may have been the valuable "*erba medica*", or medic pastures. In the same vein, Columella (7.3.20) maintains that the "grass" growth between ploughings is the best forage for sheep (White 1988:222), while he (2.14.9) observes that the viable seed in sheep's manure augments growth in the pasture phase. Another reference to the use of sheep as tools is made by Varro (II.2.12) who implies their utility in trampling straw in the course of manuring the field.

> After the harvest it is of two-fold advantage to turn the flock in on the stubble, as they will fatten on the shattered grain and improve the land for the next year's planting by spreading their manure in the trampled straw (translation of Varro in Harrison 1913:203).

Sheep are also used in Australia to control weed growth in fallow and on stubbles (Newton 1982:388), while grazing of fallow lands during arid summers and on the spontaneous growth emergent following autumn rains, is a strategy employed also in semi-arid areas of Chile (Smole 1963:55-59, 96) and Peru (Fernández-Baca 1994). In the Peruvian example, this strategy is said to provide a break from grazing for untilled pastures to regenerate (ibid.), which diverges somewhat from the South Italian practise, where untilled pastures are grazed year-round.

In Iraq during the late 1950s, a study of farming (concentrating upon irrigated crops) documented strategies similar to traditional Basilicatan practises under which livestock are grazed on fallow and untilled lands, and in "young barley" (Poyck 1962:51, see also Adams 1965:14, 169). Parallel strategies are undertaken in the Peloponnese (Koster 1977:167, 228, 256) and on Methana, Greece (Forbes 1982:135, 236, 238, 275). All of these authors emphasize the importance of the emergent spontaneous forage ("weeds" and volunteer cereals) during the summer drought when pasture production in untilled areas is suppressed.

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[10] See also Galaty (1994:186-187) for a brief discussion of Fulani pastoralists' use of stubble grazing in East Africa.

[11] Marcus Terentius Varro. *Rerum rusticarum*, B.C. 37.

[12] Columella. *De re rustica*. 60-65 A.D.

The benefits to both farmers and *pastori* accruing from the grazing of stubbles apply also to fallow lands, and like stubble grazing, the grazing of unsown fallow lands appears to be a generalized practise throughout the Mediterranean Basin and elsewhere. In Basilicata, fallow periods are variable in length, although traditionally at most a year in length. In his description of South Italian pastoralism, Portolano (1987) identifies the "bare" fallow as part of the traditional system, providing during the arid summers ". . . spontaneous forage of good nutritional quality, constituted principally of legumes, cereals and composites" (Portolano 1987:25-26). Croce (1930:36) also describes for the Mezzogiorno the traditional grazing of spontaneous vegetation in "bare" fallow, notably, especially before ploughing to sow. Parallel strategies are described by Koster (1977:228) and Forbes (1982:238, 224-225) for summer and lengthier fallows in southern Greece.

The subsidies offered under the EEC "set-aside" five-year fallow program encouraged in Basilicata a majority of farmers with sufficient land to leave a proportion unsown for this period. Rather than till the four times annually envisioned by those who drafted the program, most farmers chose to leave the set-aside fallow untilled with the resulting buildup of seed in the soils from the spontaneous vegetation. Those lucky enough to have a nearby *pastore* benefited from having their land grazed and at the same time, manured. Otherwise, as informants reflected wryly, soils were warehousing seed from the spontaneous growth.

An example of the use of sheep and goats to weed fields was provided by informants (Oppido Lucano) who described a conflict between a *pastore* and a farmer. The farmer had become frustrated with the lack of remuneration (in the form of even a basket of fresh cheese -- *ricotta*) for the grazing of his fallow and post-harvest fields by a *pastore*, and had barred the *pastore* from grazing his flock on his fields. In order to insure that the *pastore* would find no grazing there, in July the farmer ploughed under the spontaneous growth. The informants noted with amusement that the farmer had interred all the wild oats and other spontaneous plants on that land, with the result that the following wheat crop abounded with "weeds".

> Some weed species are able to compete with crops because they possess higher seedling emergence and establishment rates. *Avena sativa* has a

> competitive ability of its roots greater than its shoots. Prolific development of crown roots favours absorption of nutrients, thereby producing greater shoot growth, more tillers, a larger root system and higher seed production . . . (Guillerm 1991:384).

Wild oats are generally the first to germinate, mature and set their seed. Therefore, where they are in a standing crop that will not be cut for hay, they commonly set seed before the crop harvest. Their emergence during the summer in post-harvest stubbles is equally precocious (root growth and tillering is discussed below in light of cereal grazing). It is now general practise to request that *pastori* bring in their flocks to graze fields just before ploughing in the autumn. Again, the drop in the numbers of animals in the area has created a demand for grazing of fields. Whereas in the past there were sufficient animals to graze stubble and fallow fields thoroughly, now most farmers must rely on arranging for grazing of their fields whenever possible, but particularly pre-sowing.[13] Farmers' assertions that flocks control the abundance of wild oats are supported by experimental trials (Russi et al. 1992a:767). Under low stocking rates, spontaneous grasses in fallow fields will begin to dominate, and forage legumes will decrease. The problem is compounded by the lesser forage value of the fallow flora for grazing which leads to yet fewer livestock and a continued attrition in numbers of legumes.

The reduced number of animals available to graze post-harvest stubbles moreover, has had an impact upon the timing and efficacy of stubble burning. Commercially sold cereal seed has been selected for rapid maturation by agronomists. Cereals are therefore ready for harvest sooner than the traditional varieties. Combine harvesting contributes to the rapid removal of standing crops so that fields are left in stubble almost immediately after the cereals reach maturity. These two factors unite to leave fields in stubble from the end of the first month of the dry season (June to July) until fall ploughing for sowing (September to December). Although summers tend to be arid, precipitation does occur "out of season", and occasionally in sufficient quantity to allow germination of large numbers of seeds and stimulate growth previously suppressed by the standing crop. As I witnessed in the summer of 1994, precipitation initiated rapid germination and growth of cereals and spontaneous grasses and forbs extant in the seed bank. The bulk of this growth occurred in the fields which had been harvested first in the season -- crops of barley and oats, in particular. Given the absence of animals sufficient to check this growth, precocious, nocturnal burning of stubbles was undertaken by the majority of farmers. Despite taking this step, informants noted that the efficacy of the burn was severely reduced and only the tailings from the combines burned well. Had there been sufficient animals to consume this growth, the burns would have been more effective and undertaken later in the season.

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[13] If wild oats (*Avena sterilis*) awns are charred, the seeds germinate nevertheless (Naveh 1973 [1974a]:163-164). This ability to withstand burning was reported to me by informants throughout Basilicata -- wild oats are not destroyed by stubble burns.

Basilicata informants noted that the amount of available crop residues and post-harvest growth was significantly greater in the past. One contributing factor identified in the reduction of crop residues is the combine which has decreased the number of fallen grain heads during harvesting. The traditional method of harvesting involved a series of steps similar to those described for Calabria (Rasmussen 1968-71) and for Methana, Greece (Forbes 1982:268-269). First, the grain was cut with a hand sickle and set to the side. These cut stems were gathered into manageable bunches and tied together by another person following behind, bunches which were then stacked for later collection. A vehicle locally referred to as the *stracine* (a large sled for transporting grain) would be loaded with the harvested, tied bunches of grain for transport to the threshing floor. At each of these stages, from the cutting of grain stalks to its transportation off-field, grain loss was incurred. This was an important source of forage to grazing livestock during the summer drought (see also Croce 1930:99). However, so much grain could be lost in this process that it was at times dangerous to send out sheep and goats to graze for fear that they would consume large quantities and then, in drinking water, would die as the grain expanded in their gut. In those instances when too much grain was left behind, one of two strategies was undertaken before grazing sheep and goats. Either women would pick up the fallen grain heads by hand (gleaners)[14], or pigs would be grazed first on the grain stubbles. The change to combine harvesting which merges in one moment the cutting, collecting and threshing of grain has significantly reduced to grain loss and hence grain available to flocks grazing stubbles.[15] Germinated grain from seed fallen during harvesting, known as "volunteers" remain considerable in number, but fallen grain heads are relatively uncommon and the volunteers emerge from single grains escaping both during the reaping and after being threshed by the combine.

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[14] Gleaners appear in Biblical texts (Borowski 1987:61).

Informants identified deep ploughing as another important factor contributing to decreased post-harvest forage. By ploughing at depths greater than the 10 -15 cm possible with the scratch plough (known locally as the *aratro nostrale, aratro a chiodo*, or, in English, the ard), or the 25 - 30 cm (at the most) possible with the iron share plough pulled by animal traction, seeds are buried at depths that inhibit their germination, especially of spontaneous, annual forage legumes. Traditional Iraqi farming technology also employed the scratch plough which is described as "[loosening] the top-soil to a depth of 5-10 cms. The soil is not turned" (Poyck 1962:45).

A study at the turn of the century of traditional farming in a semi-arid Israeli valley (Elazari-Volcani 1930 in Stanhill 1978), describes a system similar to that in South Italy. Although more arid (Stanhill 1978:435), the climate is roughly equivalent to that of South Italy. In the Israeli example, the *masca'a* system (see also Noy-Meir and Seligman 1979:126) of land apportionment was in practice under which village lands were held in common and plots of 12 ha were distributed to individual fellaheen every couple of years (Stanhill 1978:437). Of the 12 ha, 9 were arable, and the remainder served as spontaneous pasture for the plough animals. Crop residues and spontaneous pasture growth plus weeds from the arable combined to form the bulk of the fodder/feed resources. Stanhill concludes that despite the insufficiency of manure to boost fertility and thereby crop yields, the traditional system is self-sustaining (1978:446, 434). Importantly here, he emphasizes that the limited plough depths of 10-15 cm under the traditional system did not affect productivity -- "it was not a factor in wheat yields" (1978:445-446). Thus, with limited land and a two-course rotation of cereals and legumes, the study spanning 1909 to 1930 records a stable system of land use (Stanhill 1978:437, 434). Stanhill's (1978) conclusions are echoed in Noy-Meir and Seligman

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[15] The only exceptions I witnessed to this rule were in the vicinity of S. Cataldo where combines are owned by few individuals who rent their services to harvest grain. In order to harvest more fields and hence make a greater profit, they commonly run their combines through too quickly which results in significant grain loss. It is also noteworthy that the smaller plots of land under cereals and those in inaccessible areas are still harvested by hand in the Avigliano - S. Cataldo area. These are also hoed or ploughed with animals rather than tractors.

(1979:128-129), who further note that the relatively shallow salt lens (in some areas only 30-40 cm below the surface) is avoided by shallow ploughing, adding that "[t]his shallow ploughing is not very effective in weed control . . ." (ibid.:127). The removal of "weeds", both during cropping and during fallow was promoted by agronomists as essential in conserving soil moisture. In many cases, however, removal of spontaneous plant growth is not ideal:

> . . . it has now been proved that water can be stored only in deep soils, and farmers who have livestock do not want to have real fallow, without the weeds that constitute the animals' only source of food (Bakhtri 1983:4, emphasis in original).

Of particular interest to the current study are the plough depth results. Informants throughout the Basilicata communities emphasized the loss of spontaneous vegetation following the introduction of deep ploughing. Deep ploughing began in the area with the introduction of industrial systems, in particular, with the mass introduction of tractors. Agronomists in Basilicata and Apulia have similarly begun to question the value and wisdom of deep ploughing, which was introduced hand in hand with the promotion of interring stubbles, monoculture (year upon year of cereals), and the application of herbicides, pesticides and artificial fertilizers (e.g. Baldoni et al. 1994:259, Caliandro and Catalano 1991; Bakhtri 1983:3 for N. Africa and the Near East).[16]

"Warm season" forage, such as amaranth (*Amaranthus* spp.) is common in fallow and stubbles in Basilicata, and has been shown to be most abundant where deep ploughing is not practised (Francia 1990).[17] This is true also of annual legumes such as clovers and medicks (Chatterton and Chatterton 1989:55; Isom and Worker 1979:203) which also produce their seed during the dry summers when they are particularly valued forage (Pardini et al. 1990:107). Described in Chapter 4, a number of mixed farmers broadcast annual clover seed into fields where stubbles had been burned to supplement spontaneous, “indigenous” forage, a practise consonant with the broadcasting of native grass seed onto burned pasture by Californian Indians (Shipek 1989:162). A proportion of the clover seed remains dormant for following years, while seed from past years, its germination enhanced by the stubble burn, emerges along with a proportion of the fresh-sown seed. This practise persists only on lands not deep ploughed (e.g. San Cataldo). The loss of perennials is also acknowledged by Basilicata farmers (who identified as a particular loss the perennial medick *Medicago sativa* var. *falcata*) and by Le Houérou (1977:364). With reference to deep ploughing, Basso (1990a, 1990b) argues that the predominantly clay based soils in Basilicata are more subject to erosion with deep ploughing, advocating instead, ploughing to depths not greater than 20-25 cm.[18] He concludes further that shallow ploughing breaks up the surface layers more effectively, thereby enhancing water absorption. These conclusions echo the recommendations of Croce (1930:150) for this area of South Italy, and more recent observations:

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[16] Noy-Meir and Seligman (1979) discuss the changes in agricultural practises in the Negev of s. Israel, among which they describe the capital intensive deep ploughing, discing, rolling and levelling preparation for sowing. Significantly, they indicate that crop yields are only marginally greater than under traditional farming (1979:148).

[17] Many species considered "weeds" have an adaptive mechanism whereby they produce abundant seeds with variable timing in germination (seed coat hardness). Mentioned previously are medicks, clovers, and other small seeded forage legumes. Others include *Chenopodium album* and *Amaranthus retroflexus*, insuring a constant presence in the soil seed bank (Speranza 1990:81).

> The characteristic functioning of this scratch plow has often been noted: it serves to break the soil from below, to cut a furrow through the soil without turning it over . . . . linked to water conservation and soil fertility maintenance in that it does not expose deeper layers of the soil to the desiccating effects of the sun while at the same time it breaks the capillary network through which moisture stored in them would otherwise escape. Butzer notes that the scratching of the "ard" also helps guard against the depletion of organic matter in the soil and against erosion since it ordinarily does not expose the more easily eroded B-horizon to the effects of the weather (1974:64) (Hopkins 1985:222).

The importance of working the surface soil layers was also emphasized by Basilicata informants, and always in light of the work accomplished by their flocks. In grazing, they argued, the animals perform small ploughings, they "work" the soil (see also Harrison 1985:92-93, quoted above with reference to Iberia). The significance of superficial tillage has been documented through experimental trials using other mechanical means in Basilicata (Caliandro and Catalano 1991). In their discussion of dry farming (*aridocoltura*) principles in southern Italy, Caliandro and Catalano (1991:380) urge ploughing to a depth of *c*. 40 cm in preparation for sowing, but followed only by superficial working of the soil to conserve soil moisture. To reduce evapotranspiration (loss of soil moisture through evaporation from the soil itself, and through plant leaves), they advocate the elimination of "weeds" combined with superficial working of the soil (see also FAO 1971). Whereas Caliandro and Catalano do not consider employing sheep and goats, these animals traditionally have been employed in precisely this role. The simultaneous use of spontaneous growth for forage during the critical summer drought, and the control of this spontaneous growth while working the soil and manuring it, is characteristic of the relationship and close integration of farming and pastoralism in Basilicata.

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[18] Schulz (1982) reaches similar conclusions in his survey of Iranian agriculture: "State intervention in agriculture in Iran has been consistent in its support for mechanized farming. Where local organizations were able to resist state intervention . . . small-scale food crop farming typically was preserved . . . When Islamic leaders took over the state apparatus in 1979, they announced plans to emphasize small and medium-sized farming over agribusiness (largely in the hands of foreign corporations). But they simultaneously promised to increase mechanization" (Schulz 1982:39). Schulz concludes that "[m]echanization is just one process that can contribute to land degradation and that nonetheless has continued unchecked because investors have been allowed to discount its costs" (ibid.:41).

Also relevant is Caliandro and Catalano's (1991:380) observation that in preparation for sowing, deep ploughing (restricted to 40 cm) is, next to hoeing, a most effective method of removing the abundant spontaneous growth which emerges in fallow fields (ibid.), reminiscent of Hartley's (1951:42-43) observations of deep ploughing as a means of "weed" seed destruction for the Middle East. The results Caliandro and Catalano (1991) present are consonant with informants' observations regarding the effects of deep ploughing on the spontaneous flora. Informants blamed the loss of this forage resource on deep ploughing and the use of herbicides, arguing that grazing livestock on this vegetation, whether in stubbles or on "bare" fallow, is effective in reducing the presence of "weeds" within the succeeding cereal crop, while preserving an excellent source of forage now greatly diminished in many fields.

Between deep ploughing and the use of herbicides designed to eliminate these latter species and other competitors (see Appendix E, Cereal Crop Herbicide Targets and Faecal Pellet Constituents) the quantity and species diversity of spontaneous plant growth has diminished sharply. In the past, fields were weeded by hand (and in some instances still are) by the cultivators themselves, or by women and children hired to perform this task. Depending upon the amount of forage/fodder available to a household, these "weeds" may have been transported as fodder for the household's animals, and in some cases, still are. "Weeds" also pulled from vegetable gardens and olive groves are commonly taken to feed penned animals.

La vezza 'nganezza, re sciuoglie ama tuglie, e le gralite enchienne nu munzette,

> *e sciamu nin marito mio che ru grano è nette* -- Proverb of Avigliano (Vetch attaches itself to the wheat and pulls it down, darnel (*Lolium* sp.) grows in tufts, wild oats fill a 25 kg wheat measuring container, and let's go husband of mine so that the wheat is clean).

Deep ploughing and the application of herbicides have led especially to a loss of vetches, clovers and medicks, a prominent example of which (and mentioned by all informants) is *Medicago sativa* var. *falcata*, a spontaneous, perennial medick genetically close to alfalfa (Kernick 1978:405-425), and a valued forage plant.[19] In the course of collecting seed samples from flour mill grain cleanings, farmers, agricultural workers and millers stopped to comment upon the recent loss of varieties of vetches of many colours, shapes and sizes; these have disappeared from areas where herbicides are in use.[20] For this reason I sought out samples from those areas ("backwards" towns) where herbicides are not applied, or have only recently come into use.[21]

Despite the diminished plant density and variety in post-harvest fields, Basilicata *pastori* interviewed in the course of this study did not report adverse effects for their flocks. The overall decrease in competition for grazing resources because of reduced numbers of animals in the region more than compensates for this loss of forage. Currently *pastori* in the Oppido, Tolve and Cancellara areas particularly, have available more pasture resources than they can use. The increase in numbers of and need for corrective burns is a strong indicator of populations well under the potential carrying capacity of the pastures. Another index of low sheep and goat populations in this area is the high demand for *pastori* to graze their flocks on private fields under cultivation.

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[19] This medick was noted to have always been of value despite impeding ploughing, making the traditional ard plough "jump", occasionally even breaking the plough because of its tough and extensive root system (it is called *lu nierv'* in dialect because it is as tough and resistant as a nerve).

[20] The mechanism within the flour mill assembly which separates grain from imperfect grains and weed seeds is called the *svecciatore* -- the "de-vetcher" -- which underscores the past abundance in tilled fields of this spontaneous, annual forage legume. Also noteworthy is the fact that informants tended to identify spontaneous vetches and other forage legumes such as *Lathyrus* generically as vetches. Moreover, spontaneous annual medics and clovers were identified as a single group: clovers.

[21] The grazing of wheat is currently restricted to areas growing the traditional varieties which are now rarely cultivated. Again, the diminished population of grazing animals and the concentration of wheat production on arable land, because of Common Market subsidies, means that the greatest proportion of cultivated fields are under wheat, and that these are not grazed until after harvest. There is also a strong correlation between the avoidance of herbicide use and the presence of animals. In fact the application of herbicides tends to be restricted to wheat crops, and only that wheat which is not grazed during its early growth.

Sheep and goats are used pre-sowing to knock back "weeds" and to hold back the spontaneous growth from setting seed. The reduction of stubble and spontaneous growth, plus the action of grazers' hooves which numerous informants remarked, break up the stubbles and "work" the upper layers of the soil horizon, all help reduce the amount of tillage necessary.

Barley, Oats and *Foraggine*

The importance of barley and its preference as livestock feed and forage is widespread in the semi-arid regions of the Mediterranean. The variable uses to which this more drought-tolerant crop can be put has also favoured its selection amongst cereals (Jones 1990:202). For example, in northwest Egypt, barley is harvested for seed if sufficient and well-distributed rainfall occurs, livestock then graze the barley stubbles. However, if a barley crop fails, then it is used as forage for livestock and is grazed *in situ* (Aboul-Naga 1987:857). Among the Bedouin of eastern Libya, barley is used for feed (Behnke 1980:46-47, 51, 65). Documented also in for Iraq during the late 1950s, barley grain was used as feed for sheep, goats and weak lambs during the winter (Poyck 1962:52-53), a practise consonant with that described by informants and observed in Basilicata. A version of the early sown barley *foraggine* for grazing is also documented for the same period in Iraq (ibid.:51). The inference in many regions where barley is grown is that it is preferred over wheat as food. However, Poyck found that:

> Although the price of wheat is twice that of barley the farmers prefer barley. It is generally assumed that wheat requires a higher fertility of the soil and that it is less salt resistant than barley. . . . From the inquiry it appeared that in the whole area barley was preferred because in addition to low fertility and salinity of the soil also barley can be utilized more profitable [*sic.*] as fodder on a farmer's holding (Poyck 1962:40).

The antiquity of using barley as fodder is suggested by Biblical (Iron Age) texts which record the use of barley mixed with straw as fodder for livestock (Borowski 1987:69), although barley is also generally considered to have been the most important cereal for bread and beer making (ibid.:7). Similarly, Noy-Meir and Seligman (1979) note that the textual evidence reveals that barley was not favoured over wheat as food, but was used nonetheless ". . . in many periods . . . for making bread and brewing beer. Otherwise, barley grain was fed to animals . . ." (1979:127).

Whereas Australian mixed farmers top seed oats into their fallow to provide early winter grazing for their sheep (Lewis and Boag n.d.; Newton 1991:388), in the Basilicatan instance, a separate field of barley or barley and oats and/or vetch[22] is sown for lactating and weak ewes, does, lambs and kids. This supplemental forage with barley as its chief component complements the early emergence of wild oats and other grasses, forage legumes, forbs and volunteer cereals (from seed lost during harvesting) in fallow lands. Depending upon the state of untilled pasture and the season's predicted growth of spontaneous plants in fallow, the *foraggine* might be protected from the mid-April onwards to be harvested as grain if only barley had been sown, or towards the beginning of May, to be cut for hay.

The *farrago*, a fodder/forage crop of cereals and legumes "sown together in varying proportions" (White 1970:215-216) appears in the writings of the Roman agronomists, and appears to be the equivalent of the *foraggine* and hay crops. White identifies three variants, bitter vetch is common to all three. The first of the three varieties is composed of vetch, barley and other legumes (Varro I.31.5); the second, is identified by the presence of light-grained emmer (*T. dicoccum*), a residue from winnowing that is sown densely with the vetch (Pliny XVIII.142); and thirdly, *ocinum*, a mixture of bitter vetch, common vetch and fava beans (Pliny XVIII.143), and possibly fenugreek (Cato XXVII). These crop mixtures for fodder and/or forage underline the variable uses to which cereals and legumes might be put, and the difficulties inherent in interpreting archaeobotanical remains as exclusively human food.

The Roman example also serves to illustrate the likely use of some cereals as fodder rather than food. This is evident in the case of oats (*Avena sativa*) which, in Roman times, were cut green for hay or fodder (White 1970:213), and in the case of barley which was typically food during times of famine (Brothwell 1988, Spurr 1986, White 1988,1970). This is no different from the reported uses by present agro-pastoralists in Basilicata.

The preference to cultivate barley for food (i.e., for bread making) is probably attributable to its drought tolerance (Noy-Meir and Seligman 1979:127) in this more arid environment, whereas barley is not favoured as human food in areas where droughts recur less frequently, such as Basilicata. Support is lent by practises documented in southern Greece where precipitation approximates more closely the southern Italian example: Forbes (1982:237) unequivocally states that barley and oats are livestock feed and not human food in his study of Greek agro-pastoralism. In the Balkans (Bosnia), barley is cultivated for livestock feed, and emmer and einkorn also are grown together for feed (locally called *'pir'*) (Ohta and Furuta 1993:42). However, the authors make no mention of green grazing or haying of these cereals.

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[22] The variations and top seeding of *foraggine* are described in detail in Chapter 4.

Returning to the Greek example, Koster (1977:321-322) reports barley cultivation in a maslin corresponding to the *foraggine*, which he refers to simply as "planted grazing", a source of high quality green forage composed of legumes (vetch and vetchling), barley and oats sown to be grazed the critical winter period of lactation (see also Koster 1977:193-194, 227, 312). Green barley sown on its own was also traditionally used as a source of quality forage in the Peloponnese (ibid.), to maximize returns from the flock by enhancing their forage and to minimize risks in the case of drought when it serves exclusively as fodder and is not protected to produce grain (ibid.:193-194). Forbes (1982:243) likewise reports the anticipated sowing of barley to provide early green grazing for sheep and goats on Methana, Greece. The strategies described by Forbes (1982) are similar to those detailed by Basilicata informants (Chapter 4).

> Households sow some barley at the very earliest opportunity for grazing their small stock on before the natural grazing is well developed. If not grazed too heavily, this barley may be left to grow over the winter for cutting green in April and drying for hay (Forbes 1982: 243-244).
>
> Both barley and oats are grown for stock. Oats are largely grown for cutting green in April and May, for hay for mules and donkeys . . . . Barley is grown primarily for its seed, primarily for feeding to chickens, but some may be used as diet supplements for lactating sheep and goats. Some barley is also cut green for hay. Barley cut for hay is often that which has been used for an early "bite" of grazing . . . . Barley may also be hayed if a farmer decides in spring that a stand will not produce a worthwhile seed crop (Forbes 1982:244-245).

The central difference between the Methana example and the Basilicatan practises appears to rest in the preference to cut barley for hay on Methana, as opposed to letting it grow for seed in Basilicata. However, among mixed farmers and *pastori* in Basilicata, the primary choice for sown early grazing (*foraggine*) is a maslin crop of barley, oats and legumes which is cut for hay.

As in Basilicata, barley and oats are also cultivated in Greece to produce cereal feed for livestock, both for work animals and for sheep (Koster 1977:358).

> Other supplemental feeds . . . in descending order of importance, barley, straw, and chaff, wheat, oats bran and potatoes. Most of the barley is grown by the household on its fields in Didyma [s. Greece, Peloponnese]. The oats are also grown locally, and as with barley, are devoted to the feeding of the work animals as well as to the sheep. In the past, these cereals represented the only source of concentrated feed, and they were used sparingly or not at all for the flocks (Koster 1977:319).

Similar observations were made by Basilicata informants of the changes from past poverty to their current relative affluence. Work animals were provided cereal grains as feed in the past, but *pastori* did not commonly use these for feed, but instead fed straw, chaff and spontaneous hay to their animals during the critical winter period.[23] Even today, the use of barley and oat grains for feed is provided only to supplement regular grazing.

Grazing cereals

> We put the sheep onto the paddocks after the barley was sown to help set the seed [press seed into the soil]. Later, you might run them on again to graze back the new growth. This produces a better crop because it makes the barley tiller, knocks back some of the weeds, and checks the young plants when they come up too early in the season . . . . mostly leaves and too little seed at that time (Lewis 1992 interview of 72 year old farmer, South Australian, Lewis and Boag n.d.).

Sheep and goats control the dissemination of "weeds" in fallow, as well as in stubbles before and after burning, but especially before ploughing and sowing. The *pastori* are sought out as they say, to perform these services for the farmers, rather than having to negotiate and make payments for grazing rights to private lands.[24] However, the animals also function as tools within growing crops. One such role is to graze cereals as a measure to counteract lodging and, at the same time increase tillering (see

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[23] Reported also for Greece (Koster 1977:191, 315; Forbes 1982:251), olive tree trimmings are still used by some *pastori* in Basilicata and Apulia (as is straw which appears to be a universal fodder resource, e.g. Forbes 1982:380; Masson et al. 1991:148) as supplementary winter fodder, and form part of traditional husbandry.

[24] The situation in Apulia appears quite different and *pastori* complained of usurious taxes placed upon them by land owners to have access to their lands for grazing. The reasons for this difference between Apulian *pastori* who deal with severely restricted and costly grazing resources, and Basilicata *pastori* remains to be investigated in future research. However, it appears that the greater aridity and soil-poor nature of the Minervino Murge area of Apulia establishes a harsher grazing environment and places at a premium access to cultivated (richer) lands. The harsher conditions provides to the landowners/farmers the power to set their own price.

Newton 1982:388 for parallel goals in wheat grazing, Australia). As is the case in the timing of stubble grazing, cereals are available for grazing during the winter stasis in pasture production, a period when flocks (particularly ewes, does, lambs and kids) benefit from the nutritional forage provided by growing cereals (see also Ungar 1992:139).

Many of the same principles in the foregoing discussion of tillering among pasture plants (Chapter 5) apply to sown cereals. That is, cereals and legumes cultivated traditionally in the Mediterranean have been subjected to grazing as a selective pressure; those plants which respond by tillering reproduce more successfully as a result of their ability on the one hand, to send out fresh shoots above ground which capture more light and crowd out competitors, and, on the other hand, to develop a more extensive, shallow root system. Hall et al. (1979:153; see also Caliandro and Catalano 1991) describe the relationship between a shallow root system and the capturing by plants of limited, brief precipitation episodes: because of their superficial location, the roots are able to absorb water which otherwise evaporates rapidly.

Barley is the most commonly and heavily grazed of the cereals in Basilicata, partly because it is a favoured forage, but also largely because it is more drought tolerant and benefits from grazing by tillering (Benjamin 1992:98). Of the three cereals cultivated in Basilicata, barley is the most flexible in terms of its potential applications (as green grazing, as fodder, and as feed). Parallels again are found in the descriptions of southern Greek farming and pastoral strategies and in other semi-arid areas of the Mediterranean Basin. Forbes (1982:223) briefly makes reference to the grazing of green barley on Methana, while the use of goats to control barley growth is also noted for Morocco (Narjisse et al. 1991:230), as it is for eastern Iraq:

> Livestock are relatively numerous, but they are not integrated with cultivation so as to constitute an effective mixed farming system. They consist mainly of herds of sheep and goats which are allowed to subsist on the natural weed growth of the waste and fallow land, supplemented by grazing on straw and stubble after the harvest and frequently an early browsing upon young barley shoots before the latter have produced ears of grain (Adams 1965:14).

The parallels between the system described above and Basilicatan systemic relations are striking. Both involve grazers in the exploitation of arable lands and in the same fashion. Although Adams (1965) argues that herding and farming are not integrated in Iraq, the similarities suggest that despite being conducted by different producers, they are integrated in practise.

Basilicatan *pastori*, farmers and mixed farmers maintain that while grazing cereals, sheep and goats also consume emerging spontaneous growth, "weeding" the cereal crop. Universally acknowledged also is that this early grazing promotes the development of tillers, secondary growth from the original plant, increasing grain yield (see also Benjamin 1992:97-98; Noy-Meir 1992:14). In the Australian example, sheep are used to graze back wheat and oats to induce tillering and also prevent lodging (Newton 1982:388; Tow 1991:29).

Whereas today the new wheat varieties have been genetically engineered to grow short stems, informants emphasized that in the past, wheat also was traditionally grazed, particularly in higher rainfall years. When precipitation occurred during early growth, cereals would be grazed to prevent the plants from developing all stem and leaf, and little grain head ("false" i.e., empty seed heads), and/or would lodge (fall over). Although wheat is now rarely grazed, a number of *pastori* noted that on occasion in recent years they had been requested to take their flocks to graze lodged barley (see Chapter 4).

That this practise is of great antiquity is suggested by the Roman agronomists, such as Pliny (18.173; 18.161; 18.180) in the 1st century A.D. (23-79 AD) with reference to the grazing crops to prevent lodging.

> In the drier wheat-growing areas, such as south Italy, Sicily and Tunisia, the seed was, and still is, sown much more thinly than in the temperate regions. Thin sowings promote the formation of side-shoots [tillering], and make greater yields possible ... the sheep [in grazing the wheat crop] reduce the luxuriant growth, promote the development of the ear, and add a top-dressing of manure. Both practices are mentioned by all our [Roman] authorities (White 1970:134).

Grazing Failed Cereals

The flexibility and risk-mitigating nature of mixed farming in drought-prone regions is a central component also of the systemic relations between Basilicatan agriculture and pastoralism. Discussed in Chapter 4, in drought years, what wheat developed a grain head, however poor, would be harvested. However, where it was clear that no grain would develop, these fields were turned over to green grazing for flocks. Again, this appears to be a widespread practise where farming and pastoralism are integrated. For example, in the northern Negev of Israel:

> In poor rainfall years, the flocks can graze the wheat when it is green as an alternative to harvesting grain. . . . The benefit of integration lies primarily in the grain-producing component acting as a buffer for the meat-producing component" (Ungar 1992:135; see also Elder et al. 1992:207).

Under traditional farming and herding strategies in the same region, Noy-Meir and Seligman (1979:132) note that both barley and wheat are grazed in drought years when the crops fail. Similarly, with reference to the Galla and Somali people of the Harar Province in Ethiopia, "[g]rain crops that failed still provided forage for livestock. Cattle were sold off to buy grain . . ." (McCown et al. 1979:320).[25] The use of failed ("drought-affected") cereals as forage is also undertaken in Australia, where ". . . leaving the crop standing [and grazed] had the additional advantage that should rain come then the standing crop would start to grow again" (Newton 1982:390).

Grazing Legume Seed Crops

Particularly in the mountain area of Tolve and Cancellara, small fava beans traditionally have been grown for seed. This is also the case in Apulia where large fields (benefiting farmers through subsidy programs there) of small fava beans are cultivated, sheep and goats are sent in to graze the emergent spontaneous growth. Farmers emphasized that flocks grazing during the early growth of the legume did not harm the sown plant, but that animals selectively consumed the spontaneous growth emergent between them, effectively reducing their competition.[26]

Documented in Syrian experimental trials, grazers avoid early growth of forage legumes generally, grazing mostly volunteer cereals and spontaneous vegetation ("weeds") that grow in amongst the legumes (Smith et al. 1989:127). Once past the initial growth period, the aversive characteristics of forage legumes diminish and the plants themselves can be grazed. It has been suggested that control of competing "weeds" is most important during the early growth period (e.g. Jordan and Shaner 1979:268). Cocks (1988:5) reports direct grazing (grazing of standing, in-field forage plants) of vetch and chickling vetch in Syria, as does Newton in the Australian example (1991:389).

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[25] It did not occur to me to investigate what arrangements were made with farmers by *pastori* when droughts occurred -- that is, what sort of exchange took place. Importantly, pastures are also afflicted by drought, which suggests that culled animals may have been offered in exchange. However, this shall be investigated in future research.

[26] "Weeds in agricultural land reduce crop yields by competing for moisture, nutrients, light, and space . . . . Control of weeds releases the nutrients and moisture for increased crop growth and yield" (Jordan and Shaner 1979:266).

Common vetch is a favoured hay crop throughout Basilicata. As is the case in Basilicata, in Turkey, vetch is used as a seed or hay crop, occasionally as green manure, and less commonly as pasture (Acikgoz 1988:48). On the island of Melos, Greece, vetch is also used as green grazing (Wagstaff and Auguston 1982:123). With reference to sheep and goats grazing on arable lands:

> Herds were seen in a variety of locations moving across harvest stubble, fallow and abandoned fields. Only occasionally did they graze on a field of some fodder crop, usually vetch (Wagstaff and Auguston 1982:123).

In Basilicata this practise is limited to grazing only during early growth stages of grain legumes. *Pastori* emphasize that in the early growth stages, their sheep and goat consume preferentially competing, spontaneous plants, and tend to avoid the growing legumes. They further maintain that if the animals get into these fields at later growth stages they damage the plants by treading on them and thereby breaking the stems.

Direct Manuring

> The benefits to the cultivator in terms of manure may be insignificant, but the trampling in of residues, breaking up of ridges, and stripping of stalks . . . are considered beneficial . . . . To deposit useful amounts of manure, animals must be corralled for several nights on a field and allowed to graze surrounding areas during the day (McCown et al. 1979:300).

What constitutes "useful amounts of manure" in this example describing the interdependencies between farmers and herders in semi-arid Africa is open to debate. In the course of grazing stubbles, fallow and growing field crops, grazers deposit dung and urine, the value of which is universally acknowledged (e.g. Berner and Wolleson 1993).[27] This ancient practise of using livestock manure as a fertilizer is clearly established in Biblical (early Iron Age) texts (Hopkins 1985:202-206). Comparisons with other practises in semi-arid areas reflect the same appreciation for and use of grazers to manure fields, even where farmers and pastoralists are separate populations (e.g.

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[27] Fresh manure contains readily degradable constituents which enhance soil microorganism activity (Berner and Wolleson 1993:54). Manure is nitrogen rich, contains also phosphates (required by legumes), potassium compounds, calcium and magnesium (ibid.:46). Sheep and goats also excrete on average 1 litre/day nutrient rich urine (Georgievskii 1981b:83). Manuring is also identified as important for maintaining soil structure, increasing water absorption and fertility which act jointly to reduce problems of erosion (Basso 1991:115).

McCown et al. 1979:297, 299-300; Noy-Meir and Seligman 1979:129).

Direct manuring universally is considered beneficial to the soil structure and nutrients by *pastori* and farmers in Basilicata (and Apulia). They maintain that sheep and goats in passing across fields deposit beneficial amounts of soil nutrients in their dung and urine[28] and also sow seed which the livestock transports across plant communities: between untilled pastures, from arable to untilled pasture and vice versa. Investigated in Chapter 5, *pastori* identified in pastures and fields, legumes which had become dominant components of the plant communities, introduced and disseminated, they maintained by their mixed flocks. These same seeds, they noted, are sown everywhere, including tilled fields. While the bulk of seeds ingested by ovicaprids are digested, a significant proportion are redeposited in their dung.

> Over a ten-day period a sheep eats one kg of seed with only 20 gm being returned in the sheep's droppings in viable condition (Chatterton and Chatterton 1989:52).

Medick seed weight varies between 2.4 and 15 mg depending upon variety (Chatterton and Chatterton 1989:16); 20 grams of viable medick seeds represent a considerable number of seeds.[29] Preliminary results of a study of the seed content of sheep and goat faecal pellets suggest that these grazers disseminate substantial amounts of seed.

The *cortiglia*, or nightly shifting of sheep enclosures for the purpose of manuring lands, was used in Basilicata both post-harvest (the fallow period between the crop harvest and sowing) and the during the year-long fallow. The *cortiglia* was particularly important in the late summer through early autumn on lands about to be tilled. Informants maintained that tilling immediately after the *cortiglia* had been undertaken was essential to avoid a loss of potency as fertilizer if the manure and urine was not incorporated into the soil soon after it was deposited.

Spreading Manure

Both in Basilicata and on Methana (Greece), legumes and manure are understood to fulfil the same role in fertilizing the soil, and in both examples manure

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[28] Phosphate-rich dung and urine expelled by the grazing animals are also essential to the growth of legumes.

[29] Using Chatterton and Chatterton's figures, over a ten day period a single sheep will deposit between *c.* 8300 and 1300 medick seeds (depending upon variety).

(especially that of ovicaprids) is spread selectively onto less fertile fields (Forbes 1982:236-237, 320). Manure from Basilicata animal pens and stalls is collected for later spreading in vineyards, vegetable gardens,[30] and onto fields to boost fertility and improve soil structure. Manure tends to be spread selectively onto fields destined for hay, because of the abundance of spontaneous "weed" seeds it contains. Some households place their manure heap on the verge of a hill below which they sow the *foraggine* as a means of further enhancing soil fertility and hence, growth and luxuriance of that forage crop. Similar methods are recorded for "S.W. Arabia" where manure run-off increases field fertility (Hartley 1951:41), and the spreading of collected manure is also documented for southern Israel in modern practise, and extrapolated also to the Roman period (Noy-Meir and Seligman 1979:129).

All landowners with animals spread manure from their barns, stalls or enclosures on their land, a practise which continues especially on lands destined for hay. Those with very few resources used all their stall collected livestock dung and human excrement mixed with ash from the hearth to fertilize their small plots of land. Informants maintained that until the advent of chemical fertilizers (introduced to the area in the 1950s), the *cortiglia* and/or manure from animal pens were the main sources of fertilizer. Where property held was too limited to undertake even a minimal fallow, legumes such as vetch and fava beans (*Vicia faba* or *Vicia faba* var. *Minor*) would be interred as green manure.[31] Those who could not afford to inter entire plants would harvest the seed for sale and inter the plant residues as fertilizer. Because labour was readily available and cheap, hand weeding cereal fields of the spontaneous growth emergent from both seed stores in the soil and from the added manure was undertaken, and as noted above, for the poorest, the "weeds" were transported from the fields for fodder (see also Koster 1977:359 and Forbes 1982:275 for Greek examples).

Sheep and goats both weed as they graze and simultaneously sow favoured forage via their manure which is a repository for seeds. These seeds later germinate to emerge as crop "infestants" in the fields. Worth recapitulating, small seeded, annual forage legumes bear variably hard seeds (Chatterton and Chatterton 1989:7, 18). The variation in seed coat thickness results in staggered germination over a number of years, enhancing plant survival over drought years. Small seed size and hard seed coats prevent seed destruction during stubble burning (the small seeds slip into openings in the soil surface, the hard seed coats protect the embryo)[32] and ingestion by grazers (small seeds are more likely to escape being masticated, and the hard seed coats protect the embryo from absorption by gastric acids) (Thomson et al. 1988:139). Both fire and ingestion act to reduce seed coat thickness and precipitate germination.

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[30] Abundant barley and vetch were observed in a vegetable garden where fresh sheep dung had been added to boost fertility (the sheep had been fed vetch and barley as feed).

[31] The use of green manuring is well-documented by the Roman agronomists; its use is proposed tentatively also to have been practised in early Iron Age Israel in conjunction with a bare fallow (Hopkins 1985:195-197).

> Another common adaptation to disturbance shown by many weeds, especially those from Mediterranean areas is the possession of morphological features predisposing the fruits to dispersal by grazing animals and to burial in soil. Genera such as *Erodium*, *Emex*, *Hordeum*, *Medicago* and *Trifolium* are characterized by fruits which aid dispersal and ensure dormancy. Germination follows as a result of intersections between aging and mechanical abrasion with combinations of temperature, moisture and light appropriate to each species (Groves 1986:137).

In their discussion of the mechanisms by which the Mediterranean landscape has been transformed by humans, Naveh and Vernet (1991) acknowledge fire as a tool in creating mosaics of, and as a tool for managing vegetation (1991:21). Importantly, they also acknowledge the role of livestock in creating and maintaining those plant communities.

> The transfer of fertility, by way of grazing animals, and of seeds by way of grazing . . . created ideal conditions for introgression and spontaneous hybridisation of wild and cultivated plant types (Naveh and Vernet 1991:23; see also Naveh and Kutiel 1989:289-290).

Even more to the point and consonant with the information communicated by Basilicata farmers and *pastori*, Naveh and Kutiel (1989) assert that:

> In the agropastoral Mediterranean landscape the seminatural vegetation utilized as "natural pastures", is closely interwoven with the agricultural vegetation of cultivated fields and plantations (Naveh and Kutiel 1989:263).

With reference to the dissemination of "weeds":

> Animals also aid in the dissemination of weed seed. The seeds of many weeds can pass through the digestive tracts of animals without losing their viability. A common method of dispersing weeds in many areas is through the droppings of grazing animals. . . . . Other seeds can cling to the hair or fleece . . ." (Jordan and Shaner 1979:271).

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[32] Naveh (1974b:429) identifies medicks and sainfoin species among others as exhibiting increased seed coat permeability once exposed to fire, and hence fire stimulated germination.

Consequently, in grazing fallow fields, stubbles and growing cereals, sheep and goats also introduce favoured forage plants through seeds which have been ingested and deposited in their manure. A significant proportion of these (see Appendix E) are annual legumes consumed in untilled pasture areas and (re)-introduced into tilled fields. The consumption, dissemination and management of spontaneous flora is a continuous process. Both manure and legumes improve soil fertility through the introduction of nitrogen, phosphorous in urine, while dung stimulates microorganisms essential to maintaining soil fertility (Berner and Wolleson 1993). At the same time, grazers consume forage and control spontaneous growth within the arable.

Ley farming emerged in South Australia with the introduction of sheep and goats, clovers, medicks and cereals, and was established, managed and perpetuated through the use of prescribed burning and controlled grazing under a crop rotation of cereals and forage legumes (Lewis and Boag n.d.). The parallels to the Italian example are noteworthy. Whereas in South Australia, the introduced flora has only recently colonized the landscape, its success has been attributed to its pre-adaptation to a regime of prescribed burning and grazing by ovicaprids (Pyne 1991:217). In the Italian instance, colonization by cereals and legumes has ancient history (although recent examples, such as *Acacia pseudacacia, Amaranthus retroflexus*, provide modern examples of analogous processes, Chapter 5),[33] and much of the flora introduced into Australia such as annual medicks and clovers, competitive grasses such as *Phalaris* spp., *Bromus* spp., *Dactylis glomerata*, and *Lolium* spp. are indigenous to South Italy and the Mediterranean Basin more generally. It is this flora which emerges in-field as excellent forage, especially important to grazers during their seed stage in the summer, both in Australia and South Italy.

In the Australian example, cereal stubbles are burned, triggering seed germination of introduced forage legumes in the second year of the cereal-forage legume rotation. While some Basilicata mixed farmers top seed their stubbles with forage legumes such as annual clovers, the emergent forage is composed largely of spontaneous, indigenous legumes such as medicks, clovers, and vetch in addition to grasses and forbs. Both the Australian and Italian rotation serve as a "weed" break, the spontaneous growth is exploited by the livestock as forage and is simultaneously controlled by their grazing. At the same time, the nitrogen fixed by spontaneous and/or introduced legumes enhances soil fertility, in conjunction with the manure deposited by grazing animals.[34] The Australian example serves to illustrate the basic relationships between controlled grazing by sheep (in Lewis' study), and cereals and forage legumes managed through burning. In the Basilicatan instance, the fallow assumes several forms, always incorporating the exploitation of spontaneous flora (dormant seed), but can include top seeded annual forage legumes, or sown perennial legumes (the stubbles of which are not burned). Whether spontaneous or sown, however, they are functionally equivalent to the self-regenerating fallow pastures sown in Australia.

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[33] Prescribed burning has also been proposed as the means by which cereals colonized Italian environments (e.g. Forni 1979, 1980, 1982).

Setting Seed

Finally, a number of Basilicata informants remarked upon the practise of using flocks to set seed when the ground is too wet to plough, although none reported recently using flocks in this way. This practise has been undertaken when the clay soils were too wet and heavy to plough. Flocks were kept on the field until they had trampled in the majority of the seed which had been broadcast onto the wet soils. Whereas in South Australia, this practise is commonplace (Lewis and Boag n.d.), in Basilicata it occurs infrequently because, as informants wryly noted, lengthy wet periods in this part of South Italy during sowing are rare. However, that this practise is widespread in the Mediterranean Basin is suggested by Borowski (1987).

> Another method used today by Near Eastern farmers to cover the seeds is to let a herd of animals on the field. The animals trample the seeds into the ground . . . . It is possible that the same method was also used in Biblical times: "Happy are those who sow beside all waters, who let the feet of the ox and the ass range free" (Isa 32:20) (Borowski 1987:54).

That sheep and goats tread seed into the soil is universally understood, as is their function in working the soil surface and incorporating their manure – in fact, it is perceived to be self-evident by *pastori* and farmers. The technical knowledge regarding the use of sheep and goats as tools, the various consequences of grazing cereals, stubbles and fallow, and the burning of crop residues are understood by farmers and *pastori* alike. The timing of grazing arable lands, of burning stubbles and preparing fields, coincides with periods of low productivity in untilled pastures. The mutual benefits of the need for additional grazing resources is intimately tied to the requirements in arable lands for fertilizer, for control of spontaneous growth, for mitigating risk of crop damage due to lodging and improved grain yield from cereal tillering response to grazing.

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[34] With few exceptions, legumes increase soil nitrogen levels through a symbiotic relationship with *Rhizobium* bacteria hosted on plant root nodules. The bacteria extract nitrogen from the air for use by their host legumes. The greatest amount of nitrogen is left in the soil for subsequent crops if the entire legume plant is interred (green manure). However, even if hay is harvested, significant nitrogen remains in the soil for subsequent crops (see Herridge 1982a:123; 1982b; Papastylianou 1987, 1988, 1990; Pannell and Falconer 1988; Chatterton and Chatterton 1989:80).

Discussion

Traditional social ascription of herding and farming as separate occupations despite the predominance of mixed farmers, obscures the functional role of the flock which binds farmers to *pastori* and incorporates arable land within the grazing regime. Neither is technical knowledge of the role of sheep and goats in farming exclusive to *pastori*. Rather, the technical knowledge pertaining to the use of fire and flocks as tools in managing the arable and untilled lands, and their various effects on sown cereals, legumes and spontaneous vegetation, is universal to *pastori* and farmers alike. All informants acknowledged and, in fact, emphasized the beneficial effects of ovicaprids to farming: that sheep and goats serve to increase tillering in growing cereals and "weed" as they graze; that they work the soil as they cross ploughed arable, preparing the seed bed, and also set sown seed in wet soils; that they fertilize soils as they pass through "bare" fallow; that they aid in reducing stubbles and concurrently hold back "weed" growth. The transmission and persistence of this knowledge which binds herding and farming is insured by the mutual benefits accruing to all participants. Even when herding and farming are undertaken by separate, specialist producers, from an extra-household perspective, the way they are integrated in practise constitutes mixed farming.

Although Ungar (1992) does not specify which aspects of the model for integrated sheep and wheat farming he describes are part of traditional farming and herding practise in the Negev (Israel), and what has been introduced, he identifies as integral, four central characteristics:

-- A grain production component, assumed here to be wheat. The grain is

> produced primarily for sale.
>
> -- A pastoral component that includes both pasture proper and grazing of wheat or wheat residues.
>
> -- A flock of sheep that derives a significant portion of its feed requirements by grazing the pastoral component, and produces lamb meat for sale.
>
> -- A management system in which grain and meat production is integrated, meaning that the crop component can be utilized for grain and/or grazing by the sheep flock according to whole-system considerations (Ungar 1992:134).

Ungar's model can be equally applied to Basilicata, to the Greek and circum-Mediterranean examples, and to Australian ley farming. While Ungar's model is too simple to represent the complexities of crop rotations and the sophisticated and complex knowledge of traditional practitioners, and fails to include legumes -- or crop rotations generally -- it underlines the importance of flexibility within farming, and its integration with pastoralism.

Characteristic of the integration of farming and herding in Basilicata is the flexibility generated by the multiple potential and actual uses of sown crops, particularly cereals. Legumes are sown for hay, seed and/or green manure, and legumes such as fava beans can be used as food, feed, or green manure, while their straw is used for fodder.[35] Cereals too serve a number of purposes, the uses to which they are put vary seasonally and shift according to crop development over the growing season. In a good year, wheat, barley and oats all can serve as forage and still be harvested as grain. Cereals are available to be grazed during a "lean" periods, that is, when untilled pasture resources are in stasis, either because of the summer drought, during the winter cold -- a period of peak demand for green grazing (lambing/kidding and lactation). Traditional varieties of cereals benefited from this early grazing by tillering, and concurrently being fertilized and weeded. In drought situations cereals are used for grazing rather than harvested, and each summer their stubbles (plus the emergent spontaneous growth) provide an important forage resource during this arid period. The anticipated sowing of barley and barley maslin crops (*foraggine*) for grazing also helps to mitigate the seasonal flux in grazing resources; these too are crops which are grazed, but if the seasonal growth in untilled pastures is abundant, the crop can also be protected from grazing to mature for seed or be harvested for hay.

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[35] However, where grain legume crops for food fail (a bruchid beetle infestation, for instance) the spoiled grains are used for feed.

As harvesting and stubble burning proceed from plains to mountains, arable lands provide a staggered grazing resource. Where stubbles have been burned in the plains, they are still available for grazing in the mountains. Once the mountain fields are ready to be burned, the plains fields have germinated fresh growth following the burn. The same applies to early grazing of cereals: crop development is similarly staggered across the vertical gradient where locally variable microclimates also help mitigate risk of crop failure (due to drought, frost, or hail, etc.), while the range of available fields across the gradient in elevations lengthens the period during which cereals might be grazed. Differential sowing and harvesting of arable lands across elevations insures the availability of green grazing during periods of low pasture productivity and high demand for quality forage.

Crop rotations which serve to rest soils also act as disease and "weed" breaks, and are undertaken within a mosaic of small fields (fragmented property) such that fallow and sown lands are intermingled, and grazing is continuously available across the landscape, providing year-round access to arable lands to *pastori* and their flocks. Self-regenerating legume pastures are pivotal in integrating the south Italian farming and herding. In south Italy these seeds form part of the soil seed bank, they are part of the "indigenous" flora. A revealing distinction made by informants between sown cereals, particularly wheat, and the spontaneous vegetation (i.e."weeds"): the former are like step-children to the soil, whereas the latter are children to the soil. The soil "protects" or looks after the spontaneous seeds in their terms, their persistence is perceived to be inevitable. Sown cereals, on the other hand, require human intervention to encourage their success. The "weedy pastures" of introduced species of grasses (such as *Phalaris* and *Lolium*) and legumes (medicks and clovers) that are part of Australian ley farming are also part of the ubiquitous, spontaneous "weed" flora in South Italy. An understanding of the roles of fire and sheep and goats in dispersing these species across the mosaic of untilled pasture lands and cultivated fields is essential to understanding not only the ubiquitous nature of these plants, but also of the genesis of these plant assemblages (communities): a mosaic of cultivated fields, fallow, woods, and untilled lands within the variable altitudinal gradient which insures a heterogeneity of grazing resources throughout the year.

The complementarity of the relationship -- the benefits to the crop ensuing from grazing by flocks, and the timing of grazing in arable coinciding with low productivity of untilled pasture resources -- insures the perpetuation of the interdependency. The flexibility inherent in this arrangement allows farmers to respond to local and regional market and environmental fluctuations, and manage their sown resources accordingly, while mitigating risk in this drought-prone area.

The technical knowledge shared by farmers and *pastori* and their complementary practises perpetuate the functional relationship between farming and herding. Introducing ovicaprids in fields as weed management tools, to control cereal growth, promote tillering and knock back competitors, to manure soils, reduce stubbles and work the soil surface is timed during periods of limited untilled pasture resources, and in winter, also periods of peak nutritional requirements for ewes, does and their offspring. The animals simultaneously import seed into these fields, primarily via their faeces, sowing their own forage, enhancing the forage value of spontaneous growth emergent in the arable, while perpetuating the need for their presence to control that growth. The burning of stubbles, primarily undertaken to ease ploughing, moreover, serves to control spontaneous growth, on the one hand, by burning spontaneous growth not palatable to sheep and goats which is not grazed back, and on the other hand, stimulating the germination of valuable forage plants.

The transmission and persistence of this knowledge which integrates herding and farming is insured by the mutually beneficial relationship, while the way they are integrated in practise constitutes mixed farming. The flexibility of the systemic relations between farming and herding enables producers to shift production goals in response to market variations and poor growing seasons, and is essential to its stability and pivotal to its success in South Italy.

CHAPTER 7

CONCLUSIONS

> The action of man over many millennia all around the Mediterranean Basin has determined extremely particular vegetation conditions . . . . . even that which today seems natural, spontaneous, may or may not be even when direct correlations to anthropogenic interventions cannot be identified. . . . In southern Apulia was recently discovered a site of human habitation dating to 31,000 BP: How has man influenced the environment in all this time? What is there that is natural? Perhaps nothing. Naturally, I intend 'natural' as 'original', something uncontaminated by any form of anthropic intervention (Lorenzoni 1987:78, my translation).

Since the Mesolithic, the Mediterranean's steep slopes and "shallow rocky soils" have been modified by swidden agriculture, grazing of livestock, coppicing of trees, fire and permanent field cultivation.

> The "natural development of climax communities without human interference" is only a myth. We must, however also be aware of the dangers of generalizing. For example, the effect of fire, goat grazing and wood cutting on Mediterranean uplands has allegedly been to turn all mountain slopes that were once forest covered into rock and scrub deserts. In many countries, many of these shallow and rocky slopes were never cultivated nor terraced and the vegetation has been probably not changed since prehistoric times (Naveh 1987:645).

Detractors over the years have suggested that traditional agricultural practices have been at the heart of environmental degradation in Italy and throughout the Mediterranean Basin. This view has been challenged by Naveh (1982a, 1982b; 1987) for Israel, and by Dall'Aglio (1991), Heichelheim (1956), and White (1963) among others, in the Italian instance. However, it has been particularly over the last three decades that botanists and ecologists have studyied the resilience[1] and evolution of Mediterranean plant communities. Arguing against past perceptions that modern Mediterranean flora represented a pauperized, degraded environment, their investigations revealed that the resilience and biodiversity of Mediterranean plant communities is directly attributable to the selective influence of recurrent drought and an extensive history of human management through burning, cutting and grazing (e.g.

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[1] Resilience is defined as ". . . the pace and manner of recovery of an ecosystem following perturbation" (Westman et al. 1981:171).

Naveh 1982b; Fox and Fox 1986:45).

Most flora is variously fire-adapted and much is fire-dependent (e.g. Arianoutsou-Faraggitaki and Margaris 1981:189; see below). In fact, fire is a recognized tool for promoting biodiversity, which in the Mediterranean is applied in conjunction with controlled grazing (Hobbs *et al.* 1995:17). Naveh and Whittaker (1979) among others (e.g. Dell *et al.* 1986:2; Hobbs *et al.* 1995:19) identify the selective pressures of cutting, burning and grazing as most significant in an environment in which the flora has already adapted to drought. The importance of fire in shaping the composition of mediterranean flora has been conclusively established (e.g. Naveh 1967, 1973, 1974a, 1974b, 1975, 1982c, 1984, 1987, 1990a; Naveh and Kuteil 1989; Naveh and Vernet 1991; Quinn 1986; Fox and Fox 1986; Margaris 1981; Forni 1976, 1980, 1982, 1984; DeLillis and Testi 1990; Mazzoleni and Pizzolongo 1990; Blondel and Aronson 1995; Trabaud 1990).

Furthermore, burning is an integral part of managing pastures, forests and arable land. The application of fire as a tool varies throughout the year in Basilicata, and is used differentially to achieve diverse goals. Spot burns and more extensive fires, for example, are used to control undesired plants and to promote the germination of fresh shoots on desired plants. Fire is used to clear overgrown areas through the use of controlled, hotter, corrective burns, whereas lighter burns are used to reduce thatch and promote germination.

> In Israel such ecosystems have changed gradually, as a result of human activities over at least 9000 years, to low scrub and annual grasslands. Over this time, selection has favoured annual herbs with a suite of biological responses commensal with human agriculture and pastoralism (Groves 1986:134).

Moreover, considerable evidence shows that once 'traditional' human management is removed, there is a considerable loss in the overall productivity of land, flora and fauna (e.g. Margaris 1981:240). Urban Emanuelsson (1988) uses the concept of 'ecological control' to describe the activities of agro-pastoralists. When their environmental management is curtailed or terminated the ecosystem's productivity drops dramatically (1988:116; see also Andersen 1988:402). Naveh refers to this phenomenon as "dynamic flow equilibrium" in which human manipulation of the environment establishes a "rich, culturally-related landscape mosaic", a landscape created and maintained by traditional agriculture, grazing, burning and coppicing (Naveh 1987:646). Abandoned areas undergoing a 'natural' succession are not only less productive communities, but are also susceptible to ruinous, 'hot' and prolonged fires (Gintzberger et al. 1990:183; Lewis 1972). The end result of fire exclusion, and termination of pasture management by cutting and grazing vegetation are fires, the ". . . high temperatures [from which] inconvertibly damage the seeds of the seed banks" (Margaris 1981:240).

> Every practise, every technique inserts itself in a coherent system, and it is this system which must be taken into account to explain the utility or inutility of fire (Métaillié 1978:525-526).

The same management technologies of burning, cutting and grazing sketched out by Mediterranean ecologists are found in Basilicata where I identified an infrastructure parallelling that identified by Lewis (Lewis and Boag n.d.) to have developed in South Australia: the cultivation of cereals in rotation with legumes, and managed through the use of sheep and goats and prescribed burning. My study of oral history, local knowledge and contemporary practises sought to identify how and if environmental differences condition the basic structure of farming and herding, and thus was predicated on a comparison across ecological zones and altitudinal (vertical) gradients. In its original conception I was to contrast farm systems across the vertical gradients that make up the highly variable, dissected topography of the study area, and research design was predicated upon productive units (farms) confining their activities within a geographically-restricted area.

Diverse microclimates which vary on the basis of aspect and elevation and create a mosaic of micro-environments are present because of the complex topography. The consequent distribution of flora along the vertical gradient on soils which "vary with the palm of the hand", comprises the physical geography within which farmers and herders enact their traditional productive cycles. Theirs is a anthropogenic landscape -- a mosaic of forested, tilled, untilled, fallow lands and pasture -- in which bilateral inheritance results in a household's accumulation of properties in a number of zones across vertical gradients. Consequently, the comparison of elevation-bound properties upon which the original research was based, was untenable. In order to retain the study's comparative method, I expanded the number of communities under study in order to contrast communities based in mountains and plains.

The results of this comparison revealed a consistency of practise across communities. First, despite the geographical and topographical variation between communities, most households, whether primarily farming or herding, make use of the ranges in elevation at their disposal. Second, and acknowledged above, household production is not confined to a narrow geographical range and differences between households within the same community could not be identified based on elevation. Finally, ranges in elevation are partially duplicated from one community to the next and the anticipated diversity between communities on the basis of micro-environmental differences became irrelevant. The most significant difference between the farming and herding practises of mountain and plains communities, was found to be the need to stockpile greater quantities of fodder as winter reserve in the mountains, and even this was a difference of degree.

In accordance with the research design, farmers and *pastori* defined system boundaries through their identification of relevant practises and functional relationships between biological elements (of interrelating sheep, goats, cereals, legumes and untilled pastures). Addressed through this research is how agriculture and pastoralism are integrated in practise through local knowledge, and how this integrated, sustainable relationship creates and maintains productive environments. The relationships identified by informants and the ways in which they are integrated may prehistorically have been the product of fortuitous associations, but are ones which were recognized, acted upon and maintained.

> Dr. Altieri explained that traditional farmers in Latin America have inherited and developed complex farming systems based on diversified cropping patterns, animal integration and low-input management. The ecological interactions and biological synergisms[2] which result from such complexity provide mechanisms by which these farming systems can 'sponsor' their own soil fertility, productivity and crop protection (de Kruijf et al. 1995).

Comparisons of farming and herding both within and between communities and their diverse environments revealed a basic pattern or infrastructure to dryland mixed farming. Composed of sheep, goats, cereals and forage legumes, fallow and untilled areas are integrated such that they form a system of relationships, an infrastructure that is intimately tied to the environment and which is itself a key factor in the formation of that environment. As in the South Australian example, the integrating feature is the mosaic of fields and fallow where ovicaprids graze growing cereals, post-harvest stubbles and emergent spontaneous growth in "bare" fallow which produces spontaneous legumes, forbs and grasses, as well as volunteer cereals through the course of the year.

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[2] A biological synergism has been defined as an "ecological association in which the physiological processes or behavior of an individual are enhanced by the nearby presence of another organism" (Zanichelli 1974: 1475). In other words, a form of mutualism.

Dry farming is by necessity, extensive farming (FAO 1971:3). While crop rotations vary on the same farm and between farms, the ideal rotation identified by all Basilicatan informants is a three year rotation of wheat the first, barley or oats the second, and a fallow the third year. Discussed in detail in Chapter 4, the most variable element of the crop rotation is the fallow, the choice of which also indicates the relative wealth of households. Land-poor households cultivate all their fallow, planting grain legumes which they grow for sale, livestock feed and household consumption. Households with more property also cultivate grain legumes, but simultaneously place other arable land under a bare and/or hay fallow. All fallows involve the cultivation of legumes -- sown and spontaneous. By cultivation, here I include the use of fire as a tool to promote the germination of spontaneous legumes, grasses and forbs (the children of the soil -- *"figli della terra"*) and the carry-over of previously sown and top seeded legumes which have become part of the soil seed bank.

Crop preferences have traditionally varied between communities and largely on the basis of relative precipitation falling in their environs. Particularly farmers in the plains are restricted in their ability to cultivate successfully a number of perennial legumes, growing instead annuals such as vetch and clovers. This restriction is mitigated by the smaller requirements for winter feed and fodder because of the absence of snow. Decisions about which crops to sow and when depends on household requirements, field location and soils: on the basis of elevation, aspect, warmth and moisture, and on the experience of wind patterns, soils, individual experimentation and accumulated local knowledge.

Most households own property in a number of micro-environments distributed across the landscape. In a universal strategy of risk avoidance, these fragmented properties allow farmers to distribute their crops across a variety of zones, reducing loss due to drought or frost. By distributing their crops across the vertical gradient and with varying aspect, farmers manage crops with one eye to avoiding complete crop failure, and the other, to varying sowing and harvest times, thereby reducing the amount of extra-household labour required.

Pastori use diverse grazing resources throughout the year across the vertical gradient. For the *pastore*, different plant maturation across the landscape expands the availability of forage for his flock, which he further extends by a careful management of pastures through burning. Altitude differences extend the seasonal availability and diversity of grazing resources along the vertical gradient, providing the forage necessary for local maintenance of flocks by *pastori*.[3] The seasonality of pasture production is further mitigated by the grazing of arable lands which are widely distributed. These lands serve as an important source of grazing during critical times of the year when untilled pasture production is inadequate for comfortably sustaining flocks. They therefore contribute to the maintenance of versatile, stable, year-round grazing resources, and reduce the impact and duration of dry-season, low forage availability.

> A particular flora of weeds has come into appearance since the beginning of agriculture; part of it is so tightly connected with agriculture the one now hopelessly seeks for its precise origin (Zohary 1983:290).

The flexibility of farming and herding and the close integration between spontaneous and sown plants is evident in their contemporaneous use. Sown and spontaneous crops are not mutually exclusive. The gathering of spontaneous hay from untilled lands is undertaken whenever a concentration of favoured forage is identified. The practise remains commonplace, whereas it was universally undertaken in the past. The use of sown hay crops was less common traditionally, and was sown in much smaller quantities in the past. Of greater importance were the *pandone* and *foraggine*. In view of the continuum of spontaneous and sown hay, the *pandone* is a spontaneous pasture, top seeded using manure, and commonly augmented with grain cleanings. The *foraggine* is also occasionally top seeded with leftover seed and grain cleanings. Sown barley is difficult to distinguish from the *foraggine*, except that it is always sown alone, and the production goal is to produce seed. However, in an poor year, this can be used as pasture (the same applies to oats), as will wheat if the crop is a complete loss. As emphasized in the preceding chapter, the different uses to which cereals are put helps to reduce losses in cases of crop failure -- due to drought or frost. The symbiotic relationship between pastoralism and farming is found in the use of sheep and goats to counter losses as well as to improve productivity.

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[3] See Verità and Cianci (1992:88) for reference to the seasonality of pasture production mitigated by vertical daily movements of flocks.

In synthesis, herding strategies were consistent across communities, *pastori* making use of resources across the vertical gradient. The variable microclimates along the gradient affect the distribution of flora which germinates and matures differentially according to its location. It is within this heterogenous landscape of fields, copses and untilled pasture across which *pastori* move their flocks on a daily basis. As they pass through the diverse plant communities, sheep and goats consume the seed of favoured forage which is carried and deposited along their grazing route, colonizing areas prepared by fire and maintained by burning and grazing. They also are used by *pastori* in conjunction with fire, to promote and enhance their grazing environment. *Pastori*'s knowledge of the complex interactions between their animals and the flora is manifested in their use of flocks as tools. Fire is either used alone or in conjunction with flocks: both are tools essential to maintaining pasture productivity.

Described in Chapters 4 and 6, the role of sheep and goats extends to arable lands where they function similarly to knock back vegetation and enhance crop productivity. The role of sheep and goats in managing tilled fields integrates pastoralism with agriculture. Animals are used as tools to create and maintain a productive landscape, as in traditional Israeli farming:

> . . . [fields] were grazed before seeding and after harvesting, facilitating the transfer of fertility and seeds to and from adjacent untillable ecotopes (Naveh 1982c:130).

All untilled pastures in this area are anthropogenic (Cavallero et al. 1992), from the use of fire- and grazing-selected species. Worth recapitulating, grazing enhances seed germination and tillering (e.g. Pardini 1993), the hooves of sheep and goats scarify the soil surface and bury seed. Described in Chapter 5, at higher stocking rates, seed bank size is enhanced (Russi et al. 1992b), and forage preferred by the animals dominates, especially where prescribed burning has been used to control less palatable plants. Upon abandonment or lower stocking rates, these favoured species decrease in numbers, and the diversity and forage value of the pasture declines. Consequently, the continued productivity of pastures depends on prescribed burning and controlled grazing.

> The significance of the ecological history of Iranian rangelands for development projects should now be clear. Under existing cultural and ecological conditions,

> the introduction of modern technologies to degraded ranges may be extremely difficult or even highly disruptive. Nonetheless, under traditional techniques, these ranges remain productive due to extensive co-adaptation among management strategies, animal foraging behaviours and plant defenses. Development projects which alter previously established relationships among organisms in these ranges are likely to have disastrously ramifying consequences (Nyerges 1982:246).

Discussed in Chapter 6, the relationship between herding and farming is symbiotic, and the technical knowledge of the multiple causes and effects of grazing and burning are shared by both farmers and herders. Local farmers' and *pastori* 's knowledge derives from personal experimentation, but particularly from that transmitted knowledge, accumulated by generations of practitioners in that region. The data shows a complex (an intricate) understanding and sophisticated management of a number of interacting, interrelating and intertwined elements. The transmission and persistence of this knowledge which integrates herding and farming traditionally was insured by mutually beneficial relationships.

> This ecological analysis of the Mediterranean agrosystem serves to explicate the complex web of strategies that are designed to minimize vulnerability and risk. They reflect not only the cumulative experience of 10 millennia of agricultural trial-and-error in a summer-dry, subtropical climate, but also local and external innovations that were tested, adapted, and disseminated (Butzer 1996:143-144).

The risk reducing nature of the traditional integration of herding and farming is most evident in the different uses to which cereals crops can be put. In this drought-prone environment, the depletion of grazing resources in untilled areas through dessication of pastures is countered by the grazing of failed cereal crops. In a mixed farm, this flexibility allows the producer to concentrate resources in the flock which, under worsening circumstances can also be severely culled and rebuilt rapidly in subsequent years.

The biological elements that comprise traditional farming and herding are more than individual components; they are integrated within complex systems and managed through a sophisticated body of knowledge which has at its base, an intimate understanding of the interactions between biological elements and their environment. Butzer (1996) arrives at similar conclusions, maintaining that

> specific plants and animals are less informative for characterizing an agrosystem than their systemic integration in terms of ecology, scheduling and management . . . Each of the components was carefully adjusted to the local environmental mosaic . . . (Butzer 1996:142).

Although mixed farmers predominate, where agriculture and pastoralism are engaged in by separate producers, the way they are integrated in practise nonetheless constitutes mixed farming. Finally, the flexibility gained through the integration enables producers to shift production goals in response to market variations and poor growing seasons has been essential to its stability and pivotal to its success in South Italy.

> Let us remember that from *pastori* we can gain precious information of the plant and animal world: the pastoral world is rich in culture that technicians must value: every good *pastore* knows all the forage resources in his territory, and knows the palatability and nutritional value of each species relative to others and also to this or that grazing animal, he knows the moment of reawakening of each and every plant and their vegetative cycles and particularly all the phases (leaf emergence, flowering, seed formation, leaf loss, dropping of fruits and seeds) which bears upon the sustenance of the flocks . . . . the knowledge of *pastori* is a cultural patrimony which must not be lost, but must be valued to the full (Iannelli 1986:156).

Iannelli's view is atypical in Italy, and of agricultural development literature for the Mediterranean Basin as a whole. Traditional farming and herding practises are conceived as archaisms rather than as intrinsically valuable and sustainable. The last 30 years have seen a dramatic decrease in numbers of livestock grazing according to traditional practise (*"allo stato brado"*), and an erosion of the whole sustainable network of interrelationships between herding and farming. Together with a reduced requirement for wood as fuel, the need for and number of corrective burns in untilled pasture has increased. Nonetheless, after burning and reintroducing sheep and goats, these areas regain their productivity. This, informants emphasized, has not been the case in arable lands. The introduction of industrial inputs -- of deep ploughing and artificial fertilizers (nitrates) and herbicides -- is encouraged through government subsidies and incentive programs. Most farmers have adopted this system, not out of a belief in its superiority over the traditional system, but out of a pragmatic weighing of profits. All condemned industrial practise for its destruction of spontaneous field flora. Whereas deep ploughing and herbicides have depleted soil seed reserves, the diminished numbers of animals available to graze arable lands is no less significant. With fewer animals grazing fields, smaller quantities of seed are being sown by sheep and goats.

This in turn, diminishes the quality of field grazing and flocks are less likely to linger and deposit greater amounts of manure. The replacement of the *cortiglia* by artificial fertilizers also reduces the opportunity to disseminate valued forage plants. Furthermore, the substitution of traditional varieties of wheat with short growing wheat also eliminates the need to have cereals grazed at which time flocks also weed out spontaneous ("weed") plants. Consequently, the application of herbicides to wheat has become commonplace, especially among those farmers who sell wheat outside the community as it must be "clean" to get a good price.

> It must be stressed that technological information and industrial methods of work are based on standardisation, uniformity and efficiency; they are completely independent of the local ecosystem and even of the local culture (Pignatti 1978:182).

It is clear that the changes over the last three decades with the introduction of industrial inputs and practise is undermining traditional systemic relations, and while *pastori* continue to take their flocks into arable lands to graze fallow and stubbles, and into fields of lodged barley, for instance, it is apparent that the herding and farming are becoming increasing alienated from one another. Nevertheless, that traditional methods continue to be practised by the vast majority of *pastori* in Basilicata may be attributed in part to their ability to sell their produce outside the formal economy. The importance of self-sufficiency , the value placed on local produce and the social relationships through which exchange and production are mediated, are also significant to the persistence of the traditional systemic relations.

> A significant feature of pastoral economies is the difficulty of taxing mobile capital in the form of animals . . . fixed-base pastoralism is not particularly easy to assess accurately for tax either, especially since (unlike for example olive trees) animal numbers tend to fluctuate from year to year (Mee *et al.* 1991:230).

Industrial systems are geared to intensive and large-scale production which is more easily monitored and accordingly producers are forced to sell through the formal economy. Conversely, small-scale, traditional *pastori* in large measure are able to avoid the formal economy. They continue to exchange produce for grazing resources and sell a large proportion of their produce informally to local customers.

Australian ley farming has become a model for agricultural development in North Africa and the Near East. However, it is from this very region that the biological components of Australian ley farming derive. Traditional farming and herding practises in the Near East and North Africa have been undermined through the introduction of industrial inputs and government subsidized livestock feeding programs. However, their traditional structure as it is described by agronomists is consistent with that found in

Basilicata. The interest on the part of farming development specialists in adopting the less complex Australian model is consequently ironic as it represents a re-introduction in simplified form, of traditional farming and herding interrelationships.

In previous chapters, I have made reference to current parallel farming and herding practises around the Mediterranean Basin which are indicative of a homogeneity of practise that also has great historical depth. Classical agronomists' texts similarly record crop rotations and uses of sheep and goats as agricultural tools, as do Near Eastern texts:

> [T]he *Nabataen agriculture* [of Ibn Wahshîya] demonstrates the common roots to agronomic understanding in the Mediterranean world and Near East, that transcend entrenched cultural boundaries. As a scientific tradition, Islamic agronomy was indeed stimulated by Greek models and enriched with their information. But we would miss the point if we overlooked that it also was primarily grounded in folk agronomy. This age-old Mediterranean-Near Eastern lifeway was based on a mix of plants and animals, adapted to summer drought and a winter growing season (Butzer 1994:19).

The subject of future investigations, the persistence of systemic relations between herding and farming in Basilicata and South Italy more generally is also suggested by archaeological evidence. In the areas of San Cataldo di Bella (Mackinnon 1993; Costantini 1983), Ruoti (Salinardi 1973; Adamesteanu 1965), Vaglio (e.g. Adamesteanu 1971, 1974), Tolve (Bottini 1982) and Oppido Lucano (Bökönyi 1994; Gualtieri 1994; Caronna 1994, 1975), votive deposits and excavated habitations have yielded bones and seeds dating from as early as the 8th century B.C., through the 5th, 4th and 3rd centuries B.C.. These reveal the presence of a mixed farming economy based upon the cultivation of cereals, legumes and predominantly goat and sheep husbandry. The votive deposits are particularly suggestive of the importance of sheep and goats to the local economy. A well-documented example from the 5th and 4th centuries B.C., yielded near-exclusively, sheep and goat bones (Bökönyi 1993:125-127; 287-288). The votive deposit is characterized as "a cultic association found in major residential complexes within fifth- and fourth-century nucleated or fortified settlements," a parallel example of which occurs in the study area at Rossano di Vaglio (Fracchia and Gualtieri 1989:217, 220-221). The shrine contained a number of terracotta statuettes and fine and coarse ware pottery among the artifacts. The sacrificial offerings of sheep/goat meat is extrapolated from the evidence of bone which display no signs of cooking or the removal of flesh (Bökönyi 1993:126-127).

> [T]he nature of the sacrificial offering of 10 subadult sheep or goats and the Italic context to which the shrine belongs have suggested that the deity is Memfitis caprina, a fertility goddess of the earth and the flocks, documented with this specific epithet at Rossano di Vaglio. At Roccagloriosa, then, we have a clear case of a local ritual in Greek dress (Fracchia and Gualtieri 1989:226-228).

The symbolic association of sheep and/or goats with the earth and fertility (above) suggests the importance of ovicaprids to the agropastoral economy. The Classical agronomists' texts and archaeological data also support continuity of the integrated practises described here. Furthermore, the close integration of flora and fauna, considered in light of the archaeological evidence implies an ancient association. In turn, this raises the possibility that under prescribed burning and managed grazing, ovicaprids and plant communities have coevolved. Finally, this study points to the probable use of these biological elements and management strategies as a colonizing instrument in antiquity. Whereas this study almost exclusively focussed on the Region of Basilicata, the strategies and interrelationships described are likely to be representative of other semi-arid areas in southern Italy. These are subjects to be explored in forthcoming research.

PLATES

Plate 1: Oppido Lucano and Bradano Valley below. 19 July 1994

Plate 2: Cancellara. 25 November 1994.

Plate 3: Avigliano (background). Sheep grazing burned pasture (foreground). 1 September 1994

Plate 4: Tolve. 21 February 1995.

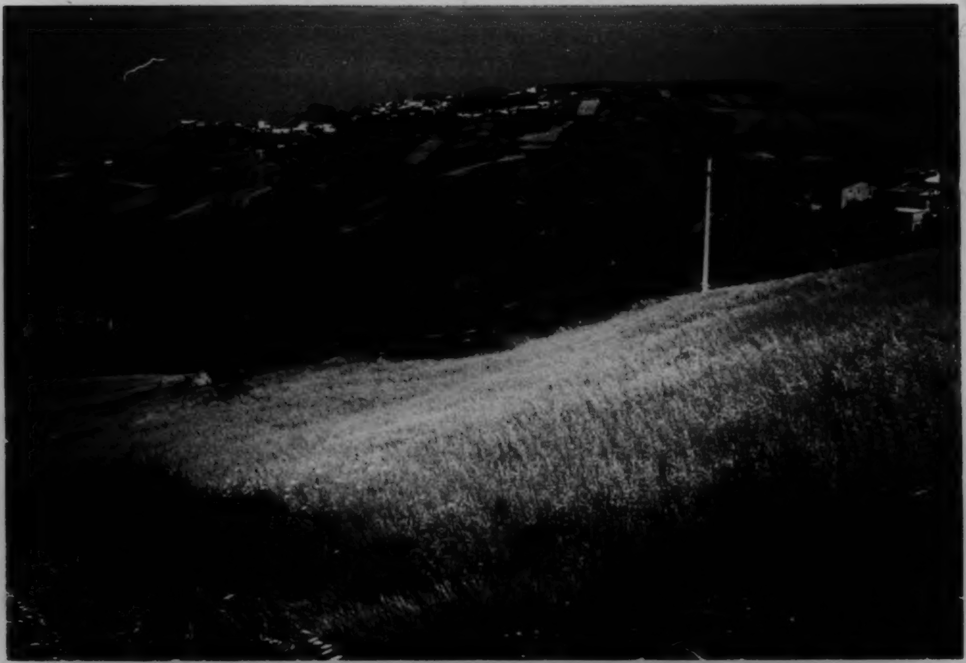

Plate 5: San Cataldo di Bella. Oats in foreground. 01 July 1994.

Plate 6: Ente di Riforma map showing land fragmentation, San Cataldo di Bella.

Plate 7: Landscape around Bella (in midground). 04 July 1994.

Plate 8: Landscape around Minervino Murge. 31 April 1995.

Plate 9: Calvello. 04 May 1995.

Plate 10. Abriola. 25 April 1995.

Plate 11: San Cataldo di Bella fodder stores. 23 September 1994.

Plate 12: Sheep and goats grazing alfalfa stubbles near Ruoti. 01 July 1994.

Plate 13. Scratch plough (*"l'aratro a chiodo/ nostrale"*) near Cancellara. 09 November 1994.

Plate 14. Iron plough (*"l'aratro di ferro"*) near Cancellara. 09 November 1994.

Plate 15. "*Strascine*" near Armento (Basilicata) 1983. Photo provided by Ernesto Salinardi.

Plate 16. Annual medick pods (*Medicago orbicularis; M. polymorpha*). 04 June 1994.

Plate 17. Hay stubbles (*Trifolium incarnatum, Vicia sativa*, and barley) -- note spontaneous annual medick pod (*Medicago scutellata*). 04 June 1994 at *c.* 650 m a.s.l.

Plate 18. Sheep grazing hay stubbles near Oppido Lucano. 10 June 1994.

Plate 19. Spot-burn below Tolve to remove *Juncus* sp. (rush family). 06 April 1995.

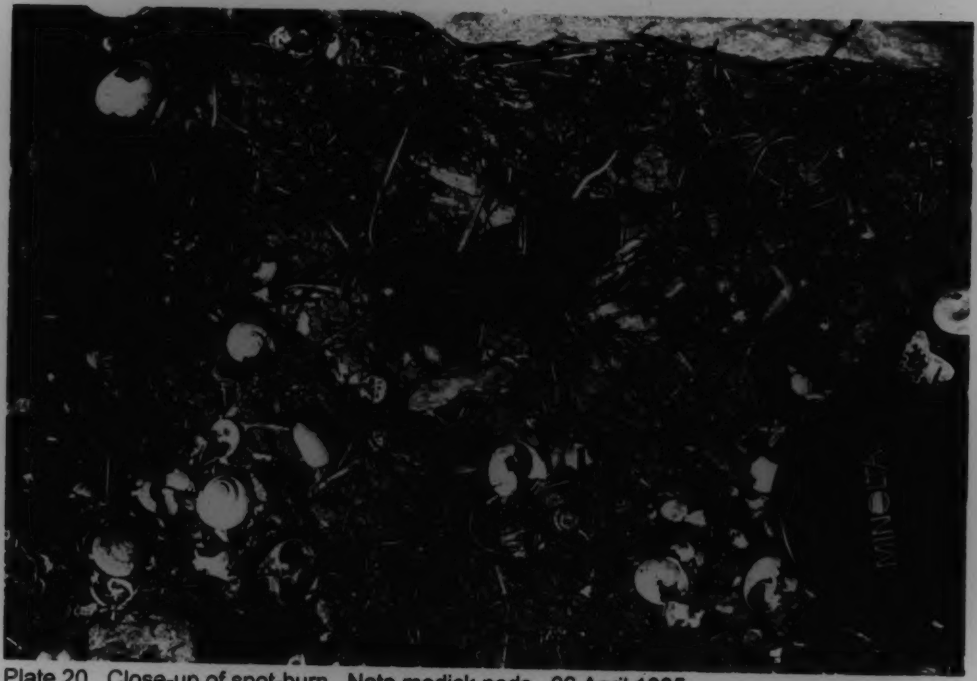

Plate 20. Close-up of spot-burn. Note medick pods. 06 April 1995.

Plate 21. Small winter corrective burn to clear *Spartium junceum* (*c.* 3 m tall). 21 February 1995.

Plate 22. Close-up of corrective burn. 21 February 1995.

Plate 23. Unmanaged oak copse. San Cataldo di Bella - Ruoti area. 23 September 1994.

Plate 24. Managed oak copse, collected kindling, spot-burn (foreground). 23 September 1994.

Plate 25. Ovicaprids grazing untilled land, control burn of brambles (midground). 08 Feb. 1995.

Plate 26. Burned wheat stubbles between Oppido Lucano and Tolve. 10 September 1994.

Plate 27. Mixed flock grazing fallow between Oppido Lucano and Tolve. *Pistacea lentiscus* bushes on slope in distance. 08 February 1995.

Plate 28. Sheep grazing near S. Cataldo di Bella on fallow of wheat stubbles top seeded with *Trifolium pratense*. 15 April 1995.

Plate 29. Goat browsing *Spartium junceum* below Tolve. 23 February 1995.

Plate 30. Comisana breed ram consuming *Astralagus* sp. along Bradano River (Irsina area). 20 April 1995.

Plate 31. Comisana cross-breed ewe grazing *Lathyrus aphaca* along Bradano River (Irsina area). 20 April 1995.

Plate 32. Dam consuming spontaneous vetch along Bradano River (Irsina area). 20 April 1995.

Plate 33. *Hedysarum coronarium* (*sulla*). Near Oppido Lucano, *c.* 600 m a.s.l. June 1994.

Plate 34. Spontaneous *Hedysarum coronarium* self-regenerating under consecutive wheat cropping and stubble burning. Acerenza in background. 27 July 1994.

Plate 35. Sheep flock at mid-day after rest period, alongside the Alvo. 13 May 1994.

Plate 36. *Vicia faba* var. *Minor* (*favino*) for green manure in vineyard between Tolve and Cancellara. 11 February 1995.

Plate 37. *Coronilla vaginalis*, *Astralagus* sp., and *Orchis* sp. in untilled pasture near Tolve, *c.* 730 m a.s.l. 30 April 1995.

Plate 38. Naturalized *Onobrychis viciaefolia* (*lupinella*) in untilled pasture near Oppido Lucano, *c.* 700 m a.s.l. 12 May 1994.

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APPENDICES

APPENDIX A: ISTAT DATA

Table A1: Data Extrapolated from the 4th Agricultural Census 1990-1991 (1992)

MUNICIPALITY	Number of farms using household labour only	Number of farms using household labour predominantly	Number of farms using extra-household labour predominantly	Total number farms	Number of farms less than 1 ha	Number of farms with 1-2 ha	Number of farms with 2-5 ha	% Total with less than 1 ha	% Total 1-5 ha	Total % less than 5 ha	Number of farms with 5-10 ha	Number of farms with 10-20 ha	Number of farms with 20-50 ha	Number of farms with 50-100 ha	Number of farms with 100 ha +	TOTAL	Number of farms with sheep	Number of sheep	Average number of sheep/farm	Number of farms with goats	Number of goats	Average number of goats/farm	Combined averages: Sheep + Goats	% Ratio Sheep:Goats (ISTAT)	% Ratio Sheep:Goats (Field data)
Abriola	356	44	22	422	52	54	93	12	35	47	75	79	52	10	7	423	104	3422	33	101	2606	26	59	57	n/a*
Anzi	317	112	20	449	108	63	124	24	42	66	53	31	44	20	7	450	102	3770	37	116	2215	19	56	63	n/a*
Avigliano	1138	67	19	1224	157	147	449	13	48	61	346	100	26	2	3	1230	495	8163	17	114	335	3	20	96	69
Bella	885	68	12	965	87	113	283	9	41	50	306	141	32	5	2	970	338	4860	14	101	628	6	20	89	69
Calvello	298	46	48	392	152	66	78	39	37	76	35	17	10	14	22	394	41	2854	70	50	1599	32	102	64	n/a*
Cancellara	305	103	27	435	103	76	122	24	45	69	52	44	32	6	0	436	57	1795	32	46	473	10	42	79	84
Irsina	1013	74	76	1163	164	78	136	14	18	32	331	204	156	72	34	1173	18	3788	210	3	132	44	254	97	80
Minervino Murge	1190	615	311	2116	597	473	527	28	22	75	237	212	161	61	36	2304	44	12324	280	25	1053	42	324	92	97
Oppido Lucano	545	97	23	665	235	90	193	31	37	68	103	70	52	13	3	759	39	1750	45	11	247	23	68	88	88
Pietragalla	848	20	13	881	135	142	317	15	52	67	193	62	28	5	0	882	155	3078	20	54	356	7	27	90	87
Ruoti	590	28	14	632	71	76	222	11	47	58	196	60	7	0	0	632	219	1812	8	106	402	4	12	82	69
Tolve	625	45	14	684	161	96	123	23	32	55	107	75	86	26	14	688	44	3325	76	52	974	19	95	77	76
Vaglio Basilicata	384	29	21	434	66	88	137	15	52	67	67	31	29	13	4	435	48	4243	88	33	839	25	113	84	80

The ratios of sheep:goats are based upon field data. These are averages drawn from interviews, compiling information on the basis of informants' most significant municipal affiliation (which forms the basis of ISTAT data). A household's pasture lands and farm lands typically fall under the jurisdiction of more than one municipality. Informants from one community frequently farm and/or hold their flocks under the jurisdiction of another municipality.

See comments in Chapters 1 and 2 discussing the reliability of information collected through the ISTAT census.

n/a* = too much variation to make this meaningful. Sheep ratios drop to less than 10% in heavily wooded areas. The area is extremely topographically variable, and my sample too small to be included.

APPENDIX A

Notes for ISTAT Data Table

This Table synthesizes data extrapolated from the Fourth Agricultural Census undertaken in 1990-1991. Its problematic nature is described in both Chapters 1 and 2, in addition to the Table note. Nonetheless, the table requires further explanation given the apparent inconsistencies with the field data.

The Table defines the total number of farms identified by the Census. Included are all properties under all forms of cultivation. As a result, individuals with an olive grove, vineyard and/or vegetable garden are incorporated in the totals. I have attempted to clarify the data by arbitrarily defining those "farms" with less than 5 ha property separately from those with more. Given my field observations, those with less than 5 ha are households whose "farm" production is limited to the cultivation and intercultivation of olives with vegetables (typically artichokes, fava beans, chick peas, etc.), and to vineyards and vegetable gardens. Except in passing, these are not discussed in this study. Because the study is limited to agro-pastoral production, it is those farms with 5 ha or more that are considered. The 5 ha cut-off is based upon the smallest amount of land held by informants engaged in agro-pastoral production identified in the course of the research. Such informants, always *pastori*, exclusively used the lands of others in addition to communal grazing to sustain their flocks. The 5 ha are dedicated as a rule, to sheds, house, vineyard, olive grove, vegetable garden and flock enclosures.

With reference to labour inputs, again, the data are misleading. The number of farms using predominantly extra-household labour, based upon my study, is inflated. This distortion may be attributed to the inclusion, by property owners, of rented lands and land under *mezzadria* (sharecropping) contracts. I came across few pastoral or agricultural households with extra-household labour. Of these, extra-household labour was not predominant. An additional factor in assessing the Table data for labour inputs is the use of agricultural labourers during peak periods, documented through the day labour records kept for agricultural pension claims. Most farming households engage friends and family within personalized dyadic contracts (defined in Chapter 2), and will document labour inputs in their production so that these individuals may then claim pensions. In the past, the notations of days worked were provided frequently without any labour having been invested -- as a form of personal favour. This practise effectively was reduced through a system of checks, but has not been eliminated. Property owners (those eligible to document agricultural labour inputs) who in the past used to document the labour of an individual in gathering olives or trimming vines which do not exist, may continue to do so, but under threat of substantial fines should the fraud be detected. Returning to the Table data, the inflated numbers of farms noted to use extra-family labour is most simply explained by the contribution of extra-household labour during peak productive periods (grape, olive harvesting, vine and olive trimming, cereal sowing and harvest).

With reference to sheep and goat statistics in the Census data, these are also at first glance misleading. Goats in the study area are kept in mixed flocks with sheep. They are not separate enterprises. For this reason, I have combined the sheep and goat statistics. It is also worth reiterating that the numbers in the Census are not reliable.

Finally, relevant statistics also appear in a recent report of the Regional government (Basilicata 1994). In a synthetic description of farm size and location, the report states that:

> 48% of the farms operate in the mountains, 40% in the hills and 12% in the plains. . . . .
>
> In the Province of Potenza the average farm size of 6.77 ha is slightly less than the Regional average [7.48 ha]; vice-versa in the Province of Matera where the average is higher at 9.16 ha, attesting to the incidence in that territory of medium and large farms (Basilicata 1994:5, my translation).

Table A2. Number and distribution of Livestock in the Region of Basilicata (extrapolated from Basilicata 1994:5).

Livestock	Number animals	Potenza	% in Potenza mountains	Matera
Sheep	346,788	78%	63%	22%
Goats	141,529	78%	63%	22%
Cattle	85,440	78%	74%	22%
Pigs	73,896	77%	n/a	n/a

APPENDIX B

THE *FIDA PASCOLO, COMUNE DI TOLVE*

The *Fida Pascolo* is a tax based upon the number of animals paid to the *Comune* (municipal government) by *pastori* in exchange for the right to graze their flocks on municipally managed, common, Crown *(Demanio)* lands. I examined the *Fida Pascolo* records in an attempt to establish actual figures for the reported decrease in animals grazing in common lands. Data for the *Fida Pascolo* were procured from the *Comune di Tolve* archives as well as the *Comune's* current records. Other sources of data regarding the *Fida Pascolo* derive from interviews with *pastori*, members of the *Comune* staff and the head of the forestry service for the area comprising Tolve, Oppido Lucano, Cancellara and San Chirico Nuovo.

Tolve was selected from amongst the other *Comuni* because it has extensive lands set aside as pasture. Oppido Lucano has limited common grazing lands and no longer applies the *Fida Pascolo* tax, which, I have been told, was applied sporadically even before it was eliminated.[1] Cancellara and S. Chirico Nuovo likewise have little pasture administered by their *comuni*. Numerous *pastori* from Cancellara, Oppido Lucano, S. Chirico, and Vaglio graze their flocks in the Tolve zone.

I sought representative records in the archival data for a full year's grazing from each of the following periods: 1900, 1940, 1960, and 1995. Having viewed the material, it became plain that information up to the mid-1920s was not comparable. During this period, the *Fida Pascolo* for each area was awarded by the *Comune* to the highest bidder, and not to individual *pastori*. These records report only bidding for and contracts awarded, with infrequent and partial notations regarding animals to be grazed in common lands. Monied and propertied members of the community bid for these lands in which they grazed their large herds and sublet grazing to as many *pastori* as possible, making a considerable profit. No records exist of these sublets, nor of the animals and numbers grazing in the Tolve common lands under these contracts. In fact, until the mid-1920s there appear not to have been any limits to or control over numbers of animals grazing common lands. I selected the most complete annual records from the periods 1940 - 1950 and 1960 - 1970, which were those from 1943 - 1945 and 1967 - 1969. I expanded the 12 month period to 18 months to incorporate both summer an winter grazing for more complete data. Finally, I gathered data from current *Fida Pascolo* contracts for the period 25 November 1993 to 25 May 1995.

The *Fida Pascolo* data as a whole are disappointing. With many gaps and inconsistencies, the registers report only the absolute *minimum* number of animals grazing each *demanio*, and the full range of livestock grazed are not recorded. The registers are therefore not reliable documents. However, factors other than poor record-keeping contribute to the underrepresentation of animals in the *Fida Pascolo* records.

One such factor and a recent development, is that the *Comune* no longer controls the numbers of animals present and therefore no longer fines owners for those animals not reported and for which no head tax was paid. Informants have described how in the past the *guardie campestri* (rural guards responsible for common lands) would catch them grazing a flock in excess of the numbers declared in the *Fida Pascolo* registers. Depending upon the *guardia*, *pastori* would be either fined, or allowed to "fix" the problem by bribing the *guardia* with cheese, a lamb or a kid. The "supplementary" registers of the *Fida Pascolo* occasionally make reference to animals in excess of those declared, and the charging of a *'doppia fida'* fine (double payment) for those animals. Typically, however, informants report that *guardie campestri* could be and were bribed so that fines were infrequent or much-reduced. Hence, the recorded fines are far from representative, and the fines registers unfortunately do not increase the accuracy of the *Fida Pascolo* records. Exacerbating this problem, many *pastori* did not (and do not) register to graze their animals in common lands. These *pascoli abusivi* (illegally grazing animals) were common in the past, but are rampant today because of the absence of enforcement.

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[1] I sought out the *Fida Pascolo* records from the *Comune di Oppido Lucano*, but they were not available, the archival system being in a state of confusion.

Yet another factor promoting underreporting of animals grazing common lands is a strategy which continues to be employed today by *pastori* to get around the problem of being "caught" in common pasture. *Pastori* will rent (preferably) or purchase a piece of property on the other side of a common pasture. The *Comune* grants to Tolve residents the right to pass through common lands for only a nominal annual fee[2] while driving flocks from the fold to private pasture (fallow lands, cereals, stubbles, leguminous forage, abandoned fields, etc.). That the animals leisurely graze their way through and fill-up before they arrive to the target field on the other side of the common grazing, and then graze through again on their way back, is the objective underlying this common tax-evading tactic.

Finally, by law, the *Comune* can only permit grazing of a limited number of animals. Due to this rule, actual numbers of animals grazing are under-reported. For example, if the *Comune* receives three applications to graze 100 animals each in a zone for which only 100 animals are allowed, in order to be democratic the *Comune* grants to one applicant the permission to graze 30 animals, and to the other two, the permission to graze 35 animals each on the pasture. These numbers are then transposed in the records. In practise, for strategic and economic reasons (such as labour costs), *pastori* do not divide their flock or herd between pastures, but rather graze all 100 animals with a permit for only 30 or 35, thereby exceeding the maximum allowable. The local government and forestry service are fully aware of this practise.

Because of these many sources of inaccuracy, the *Fida Pascolo* record is unhelpful in establishing real stocking rates and livestock numbers generally. Nonetheless, the records do suggest the seasonal presence of transhumant ovicaprid flocks and cattle herds. They also indicate a preference for grazing cattle and pigs together in select pastures (a general rule with numerous exceptions), separate from ovicaprids, as described above (Chapter 5). Most importantly, the failure of the records to report accurate numbers of animals, illuminates various strategies employed by *pastori* to avoid cash payments and access "free" pasture. A summary description of the common grazing lands is presented below. Appended are also charts and tables summarizing the data collected.

The common grazing lands of the *Demanio di Tolve* are divided according to their geographical location -- a diversity reflected in the predominant vegetation in each. These differences are also reflected in broad terms by the types of animals (and numbers) favoured for pasture, and the periods of restriction (or absence of these) for grazing in each zone. Common lands rented under the *Fida Pascolo* are largely wooded areas and spontaneous pasture (untilled) lands categorized as *pascolo cespugliato* (bush pasture, *saltus* and *silva*). Informants generally lump *pascolo cespugliato* and *macchia* under one term: *saldone*. *Saldone*, more precisely is used to designate areas almost bereft of vegetation. True *saldoni* also fall within the *demani* of the *Comune di Tolve*. The large part of these however, are wooded and/or *pascolo cespugliato*.

The *Demanio di Macchia Orsino* (*c.* 460 ha) is composed of vegetation ranging from treed pasture *(pascoli arborati)*, "bare" pasture *(pascoli nudi)*, to oak forest *(bosco di alto fusto quercini)*. *Iscone*, another *demanio* intermittantly noted in the archival documents, is directly across a seasonal *torrente* (stream) from Macchia Orsino, but forms part of the same complex. Iscone's infrequent appearance in the records (data limited to the 1941-1943 period) results from its having been lumped together with Macchia Orsino in most records. Macchia Orsino and neighbouring Iscone lie between 200-300 m a.s.l., an altitude at which snow rarely falls, and for this reason are favoured winter pasture. Grazing is restricted by law to the winter period *(vernotica)*[3] of 25 November to 31 May. Grazing from June to the end of November is therefore prohibited in this zone. The data retrieved from the archives indicates this. The actual situation is (and probably was) much different. At the time of field research, Podolian-cross bred cattle far in excess of the established 164 maximum were grazing here year-round (see above). Numbers from 1941-1943 and 1967 - 1969 are also well in excess of this maximum.[4]

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[2] Approximate charge is £50, 000 (*c.* $50 CAN.).

[3] The division of common lands grazing into winter *(vernotica)* and summer *(statonica)* is of some antiquity, noted by di Bérenger (1965) from Roman times, the system itself of the *fida* also dates from this period (1965:765-766).

The *Demanio di Guardiola* is an area of approximately 700 ha composed of "bare" pasture and oak forest (similar in nature to Macchia Orsino). This is considered summer pasture *(statonica)*. At 1100 m a.s.l. it is generally snow-covered during the winter and cannot be grazed. The data reveal cattle grazing this area during the 1994-1995 winter probably because of the paucity of winter snowfall, the animals could subsist there. The summer grazing period runs from 01 June until 25 November. The maximum number of cattle allowed to graze this pasture is set at a 100. This seems low for the 700 ha, but is explained by the prohibition to graze 400 ha of those. The forestry marshall indicated that in 1975, 200 ha of the forest was burned, apparently the result of a dispute beween two *pastori*. This area is currently closed to grazing. Another 100 ha have been closed to grazing as part of a *Ricostituzione Boschi* program designed to promote forest regrowth.

The *Domanio Marchigliuzzi* forms part of the Guardiola complex and is composed of shrub pasture *(pascolo cespugliato)* and forest *(bosco di alto fusto)*. At approximately 550 to 650 m a.s.l., this pasture now is grazed almost exclusively by the flock of one *pastore*. For this area, 150 sheep or goats is the official maximum allowed. The disparity between this number and actual flock size is typical of the lack of congruency between law, records, and reality. Data from the previous periods do not exist, probably because this area was lumped-in with the Guardiola pasture.

The *Demanio di Chiaromonte* is a pasture of 913 ha open to year-round grazing, with a high stocking rate of 3050 ovicaprids or 305 cattle.[5] The proximity of readily accessible cultivated terrains (bordering common lands) on which the *pastori* graze their flocks post-harvest, allows the grazing of these pastures through the summer. A number of farmers are reported to resent the grazing of flocks in their fields post-harvest without permission, and out of spite *(per dispetto)* burn stubbles early to remove this source of forage.

The *Demanio Vignali*, on a hill facing Tolve, is a somewhat unusual pasture in that it rarely appears in the *Fida Pascolo* contracts. Currently there are two flocks in this area, one of *c.* 80 sheep and another of *c.* 150 sheep and goats, both of which make use of the "right to passage" law that stipulates that flocks can be driven through the forest to graze on abandoned lands, fallow, stubbles, and so on (see above).

The *Demanio Difesa di Piedi* is now composed of a mixed forest (oak and pine) planted in the 1950s. Conifers here include Aleppo pines, domestic pines, cypresses, eucalyptus (not at all suitable for pastures). This area was *saldone* before being planted to forest, and supported a higher stocking rate than is the case today.[6] This zone is currently restricted to winter (25 November to 10 May) sheep grazing, limited by the *Comune* to 200 head. As usual, there is a great lack of congruency between numbers allowed and reported in the municipal records. Actual flock size is much larger, includes goats, and is grazed year-round.

Finally, the *Demanio Moltone* is characterized as a mature, open, oak forest (*bosco di alto fusto specie quercina*). This area is similar to *Vignali* in that many *pastori* graze their flocks abusively, having only the right (established by law) to pass through the forest to water their flocks at the river Alvo. *Pastori* supposedly pay the nominal fee to the *Comune* for this right of passage to the Alvo. However, these should be recorded in the *Fida Pascolo* registers, and are not. Many more animals graze this area than are accounted for in the *fida pascolo* records.

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[4] The maximum number of animals allowed is mentioned only in 1993 documents and may therefore not have been established during the earlier periods, or else the numbers were not "adjusted" in the records to total only the numbers allowed.

[5] Stocking rates tends to be based upon a formula of 3 ha per head of cattle or 3 ha per 10 ovicaprids.

[6] The 1941-43 *Fida Pascolo* register (before the forestation) establishes a 400 ovicaprid (40 head cattle) carrying capacity.

APPENDIX B: FIDA PASCOLO RECORDS

Table B1: Macchia Orsino

ISCONE	11-1941	12-1941	01-1942	02-1942	03-1942	04-1942	05-1942	06-1942	07-1942	08-1942	09-1942	10-1942	11-1942	12-1942	01-1943	02-1943	03-1943	04-1943	05-1943
Sheep	350	350	350	350	350	350	350	150						397	397	397	397	397	397
Goats	31	31	31	31	31	31	31	15											
Cattle								2											
Pigs	39	39	39	39	39	39	39	16						24	24	24	24	24	24
Horses																			

MACCHIA ORSINO	11-1941	12-1941	01-1942	02-1942	03-1942	04-1942	05-1942	06-1942	07-1942	08-1942	09-1942	10-1942	11-1942	12-1942	01-1943	02-1943	03-1943	04-1943	05-1943
Sheep	59	59	59	59	59	59	135												
Goats	18	18	18	18	18	18	25												
Cattle	346	346	346	346	346	346	351	87						15	15	15	15	15	15
Pigs	77	77	77	77	77	77	78	11											
Horses																			

MACCHIA ORSINO	11-1967	12-1967	01-1968	02-1968	03-1968	04-1968	05-1968	06-1968	07-1968	08-1968	09-1968	10-1968	11-1968	12-1968	01-1969	02-1969	03-1969	04-1969	05-1969
Sheep	???	498	498	498	498	499	499							399	399	399	399	399	399
Goats	???																		
Cattle	???																		
Pigs	???																		
Horses	???	3	3	3	3	4	4							6	6	6	6	6	6

MACCHIA ORSINO	11-1993	12-1993	01-1994	02-1994	03-1994	04-1994	05-1994	06-1994	07-1994	08-1994	09-1994	10-1994	11-1994	12-1994	01-1995	02-1995	03-1995	04-1995	05-1995
Sheep																			
Goats																			
Cattle	164	164	164	164	164	164	164						145	145	145	145	145	145	145
Pigs																			
Horses																			

ISCONE: November 1941 - May 1943
This area is considered to be part of Machia Orsino. Its pasture composition is identical to that of Macchia Orsino. Ten pigs were grazed on these pastures from December 1994 to February 1995, and a notation to the effect that no animals were allowed in the pasture from 25 November until 25 January evidently did not apply to the pigs. No other information is recorded for the period 1993-1995. The *Fida Pascolo* register for 1967-1969 does not mention Iscone. This probably reflects the "lumping - together" of Iscone with Macchia Orsino.

MACCHIA ORSINO: November 1941-May 1943
To judge from the disparity in the data from one year to the next, these records are probably incomplete (December 1942 - May 1943). The records also reflect only one half to one third of the numbers of animals actually grazing here.

MACCHIA ORSINO: November 1993 - May 1995
The 164 cattle represents the legal limit for grazing, but actually underrepresents the real numbers by one-half at the very least (164 head cattle is closer to 30% of the actual cattle grazing). Most claimed less than 50% of the animals actually present. Furthermore, the records do not reveal the illegal grazing of this area by cattle during the summer months. Also noted grazing the pasture here were at least a dozen pigs. similarly absent in the *Fida Pascolo* registers.

APPENDIX B: FIDA PASCOLO RECORDS
Table B2: Difesa di Piedi

DIFESA	11-1941	12-1941	01-1942	02-1942	03-1942	04-1942	05-1942	06-1942	07-1942	08-1942	09-1942	10-1942	11-1942	12-1942	01-1943	02-1943	03-1943	04-1943	05-1943
Sheep	442	582	582	582	582	582	772	90				95	672	512	622	622	597	597	487
Goats		3	3	3	3	3	3						15	15	15	15	15	15	15
Ovicaprids							280	280											
Cattle		6	6	6	6	6	123	112					24	24	24	24	24	24	24
Pigs													24	24	24	24	24	24	24
Horses																			

DIFESA		11-1967	12-1967	01-1968	02-1968	03-1968	04-1968	05-1968	06-1968	07-1968	08-1968	09-1968	10-1968	11-1968	12-1968	01-1969	02-1969	03-1969	04-1969	05-1969
Sheep	???		167	167	167	167	167	167							60	60	60	60	60	60
Goats	???		49	49	49	49	49	49							24	24	24	24	24	24
Cattle																				
Pigs																				
Horses																				

DIFESA	11-1993	12-1993	01-1994	02-1994	03-1994	04-1994	05-1994	06-1994	07-1994	08-1994	09-1994	10-1994	11-1994	12-1994	01-1995	02-1995	03-1995	04-1995	05-1995
Sheep	15	155	155	155	155	155	155	15	15	15	15	15	15	140	140	140	140	140	140
Goats																			
Cattle																			
Pigs																			
Horses	5																		

DIFESA DI PIEDI: November 1941 - May 1943
The carrying capacity for this pasture is set by the *Comune* at 400 ovines or 40 cattle (again a 10:1 ratio). The grazing period extends from 25 November until 10 May. As elsewhere, the sheep category may include goats in the total. Payment per head sheep or goat was the same, and I suspect that an administrative short-cut was taken in recording both sheep and goats as *ovini* (sheep).

DIFESA DI PIEDI: November 1967 - May 1969
Very limited data were available for this period. The records show only a couple of shepherds using this area. Winter (*vernotica*) grazing begins 25 November. I record it here as though it initiates the 01 December.

DIFESA DI PIEDI: November 1993 - May 1995
Again, these numbers are very low. One shepherd grazing his flock in this area (an informant) had a minimum of 250 sheep and 90 goats on this pasture.

APPENDIX B: FIDA PASCOLO RECORDS

Table B3: Guardiola

GUARDIOLA	11-1967	12-1967	01-1968	02-1968	03-1968	04-1968	05-1968	06-1968	07-1968	08-1968	09-1968	10-1968	11-1968	12-1968	01-1969	02-1969	03-1969	04-1969	05-1969
Sheep			65	452	166	8	8							6 ???					
Goats			15	135	87	194	194						64	72 ???					
Cattle				29	47	51	89	146	158	146	146	146	146	32 ???					
Pigs	138	60	80	138	145	146	147						170	218	29				
Horses						1	1	2	2	2	2	2	2	???					

GUARDIOLA	11-1993	12-1993	01-1994	02-1994	03-1994	04-1994	05-1994	06-1994	07-1994	08-1994	09-1994	10-1994	11-1994	12-1994	01-1995	02-1995	03-1995	04-1995	05-1995
Sheep																			
Goats																			
Cattle	100							195	195	225	225	225	95	95	95	95	95	95	95
Pigs																			
Horses																			

GUARDIOLA: November 1967 - May 1969
The *Comune di Tolve* allows for year-round grazing of these pastures. However, see 1993-1994 comments below. The *Fida Ghiandifera* (acorn tax) is also imposed upon pigs in these common grazing lands from 15 October to 17 January.

GUARDIOLA: November 1993 - May 1995
Grazing laws in this area are contradictory. Posted law allows year-round grazing. However, the registers allow grazing only between 25 May and 25 November. For the period of December 1994 through May 1995, the *Comune* allowed grazing. However, this confusion is readily explained by the high altitude of the pastures (1100 m a.s.l.) which generally lends grazing over the winter months unfeasible because of snow. The winter of 1994-1995, however, was mild and dry, accumulations of snow were minimal and ephemeral. As a result, cattle herds were brought in to graze out of season. The numbers registered are extremely low. Less than half (closer to 30%) are registered as grazing. The *Fida Ghiandifera* applies to this pasture as well. Again, the numbers registered do not reflect the actual animals present, particularly because of the number of *pascoli abusivi* (illegally grazing animals).

APPENDIX B: FIDA PASCOLO RECORDS

Table B4: Moltone Table B5: Marchigliuzzi

MOLTONE	11-1967	12-1967	01-1968	02-1968	03-1968	04-1968	05-1968	06-1968	07-1968	08-1968	09-1968	10-1968	11-1968	12-1968	01-1969	02-1969	03-1969	04-1969	05-1969
Sheep	???	290	290	290	345	80	80	50						150	45				
Goats	???	120	120	120	145	20	20							27	???				
Cattle	???							161	161	161	161	161	161		???				
Pigs	???														???				
Horses	???														???				

MOLTONE	11-1993	12-1993	01-1994	02-1994	03-1994	04-1994	05-1994	06-1994	07-1994	08-1994	09-1994	10-1994	11-1994	12-1994	01-1995	02-1995	03-1995	04-1995	05-1995
Sheep	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
Goats																			
Cattle																			
Pigs																			
Horses																			

MOLTONE: November 1967 - May 1969
For this area is listed a separate payment category: *Fida Ghiandifera*. This tax for acorns applies to pigs grazing in this area between 15 October and 17 January. The existance of the tax specific to these grazing lands suggests that pigs were regularly grazed here, although not reflected in the records. A density of three sheep per ha is the allowable legal limit here.

MOLTONE: November 1993 - May 1995
These numbers are extremely low. For this period to my knowledge, at least 300 sheep and 100 goats grazed the Moltone. I am also aware that a number of cattle are grazed here.

MARCHI.	11-1993	12-1993	01-1994	02-1994	03-1994	04-1994	05-1994	06-1994	07-1994	08-1994	09-1994	10-1994	11-1994	12-1994	01-1995	02-1995	03-1995	04-1995	05-1995
Sheep	200	200	200	200	200	200	200	200	200	200	200	200	200						
Goats	70	70	70	70	70	70	70	70	70	70	70	70	70						
Cattle																			
Pigs																			
Horses																			

MARCHIGLIUZZI: November 1993 - May 1995
Comparisons between the numbers of animals in the *Fida Pascolo* register and those numbers collected through interviews reveals again, that the *Fida Pascolo* greatly underrepresents the actual livestock grazing on these common lands. A minimum of 400 sheep and 120 goats graze on these pastures. Furthermore, I interviewed shepherds grazing on the Marchigliuzzi pasture during January and February 1995. There are no records of these flocks on the pasture in the *Fida Pascolo* register for 1995.

APPENDIX B: FIDA PASCOLO RECORDS
Table B6: Chiaromonte

CHIAROM.	11-1941	12-1941	01-1942	02-1942	03-1942	04-1942	05-1942	06-1942	07-1942	08-1942	09-1942	10-1942	11-1942	12-1942	01-1943	02-1943	03-1943	04-1943	05-1943
Sheep	1154	1154	1154	1154	1154	1154	1154						180	830	830	680	680	180	
Goats																			
Ovicaprids														75					
Cattle	20	20	20	20	20	20	20												
Pigs	5	5	5	5	5	5	5							75	51	51	61		
Horses																			

CHIAROM.	11-1967	12-1967	01-1968	02-1968	03-1968	04-1968	05-1968	06-1968	07-1968	08-1968	09-1968	10-1968	11-1968	12-1968	01-1969	02-1969	03-1969	04-1969	05-1969
Sheep					220	270	286	475	475	825	325	325	325	673					
Goats							18	38	38	38	30	38	38	36					
Ovicaprids													200						
Cattle							7												
Pigs																			
Horses																			

CHIAROM.	11-1993	12-1993	01-1994	02-1994	03-1994	04-1994	05-1994	06-1994	07-1994	08-1994	09-1994	10-1994	11-1994	12-1994	01-1995	02-1995	03-1995	04-1995	05-1995
Sheep	459	65	65	65	65	65	65	390	390	240	240	240	240	245	245	245	245	245	195
Goats	58	23	23	23	23	23	90	90	90	20	20	20	20	15	15	15	15	15	15
Cattle	164	164	164	164	164	164	164						145	145	145	145	145	145	145
Pigs	45		15	15	15	15	15	15	15										
Horses	5	6	6	6	6	6	6	6	6										

CHIAROMONTE: November 1941 - May 1943
The Table shows that for the winter (vernatica) grazing period (15 November until 31 March), a total of 1154 sheep, a single herd of 20 cattle and one of 5 pigs, were grazed in this area. The duration of their grazing varied from one to four months (sheep herd size varying from 70 to 232 head). The number of months each group was grazed in the Chiaromonte pasture is not specified in the archival documents. Year-round grazing is permitted in this pasture of 913 ha. Carrying capacity is set at 3050 sheep or goats, or 305 cattle (stocking rate 10 ovicaprids: 1 cow).

CHIAROMONTE: November 1967 - May 1969
An additional 35 cattle were grazed in this pasture for two months (unspecified) between June and December. Again, the problem of sheep and goats being combined emerges in the records for this pasture (the same head tax). In fact, I suspect that the numbers throughout the *Fida Pascolo* documents overrepresent sheep (not taking into consideration the underreporting of animals and illegally grazed flocks), and underrepresent goats.

CHIAROMONTE: November 1993 - May 1995
These number are extremely low. The numbers claimed are roughly half, if not less than half of the herds declared. These statistics also do not reflect the abundance of animals grazed here illegally. Among these unreported animals are cattle grazed during the summer months.

APPENDIX C

PRECIPITATION AND TEMPERATURE DATA

Contents:

1. Mediterranean Climate and Vegetation Boundaries.
2. Distribution of Average Precipitation in Basilicata (1921-1980).
3. Distribution of Average Annual Temperature in Basilicata (1921-1980).
4. Approximate 30 Year Precipitation Averages (mm) at Research Sites.
5. Basilicata and Minervino Murge (Apulia) Monthly Precipitation Averages (mm) 1921-1980.
3. Potenza (Basilicata) Average Monthly Precipitation 1988-1994 & Average (1921-1980) at 826 m a.s.l.
6. Potenza (Basilicata) Average Monthly Maximum and Minimum Temperatures (°C) 1926-1980.
7. Charts of Monthly Average Temperatures (°C) at Potenza (Basilicata) 1926-1955.
8. Potenza (Basilicata) Extremes in Monthly Temperatures (°C) 1926-1980.
9. Charts of Monthly Temperatures Extremes (°C) at Potenza (Basilicata) 1926-1955.
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11. Avigliano (Basilicata) Monthly Precipitation Averages 1951-1988 & Average (1921-1980) at 910 m a.s.l.
12. Cancellara (Basilicata) Monthly Precipitation Values Average (1921-1980) at 620 m a.s.l.
13. Average Monthly Precipitation at Tolve, Ruoti and Vaglio (Basilicata).
14. Bella and Irsina (Basilicata) Average Monthly Precipitation.
15. Minervino Murge (Apulia) Annual Total Precipitation 1951-1994 at 445 m a.s.l. (average 596 mm).
16. Monthly Average Precipitation Minervino Murge 1951-1994 Data.
17. Minervino Murge Precipitation Variations.

Precipitation data sources:

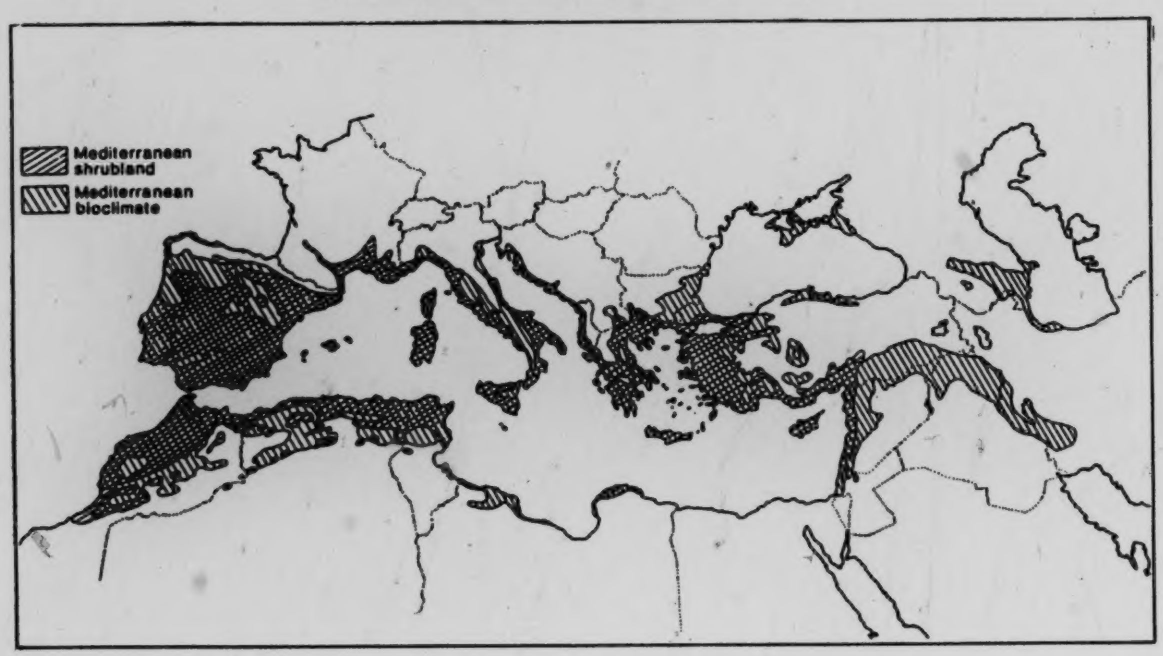
Caloiero, D. , R. Niccoli and C. Reali
1993 Le Precipitazioni in Basilicata (1921-1980). Consiglio Nazionale delle Ricerche, Istituto di Ricerca per la protezione Idrologeologica nell'Italia Meridionale ed Insulare. Cosenza.

Annali Idrologici, Sezione Autonoma del Genio Civile con Sede in Catanzaro per i Bacini con Foce al Litorale Jonico e Tirrenico dal Bradano al Lao. Ministero dei Lavori Pubblici, Servizio Idrografico. Istituto Poligrafico dello Stato: Rome.

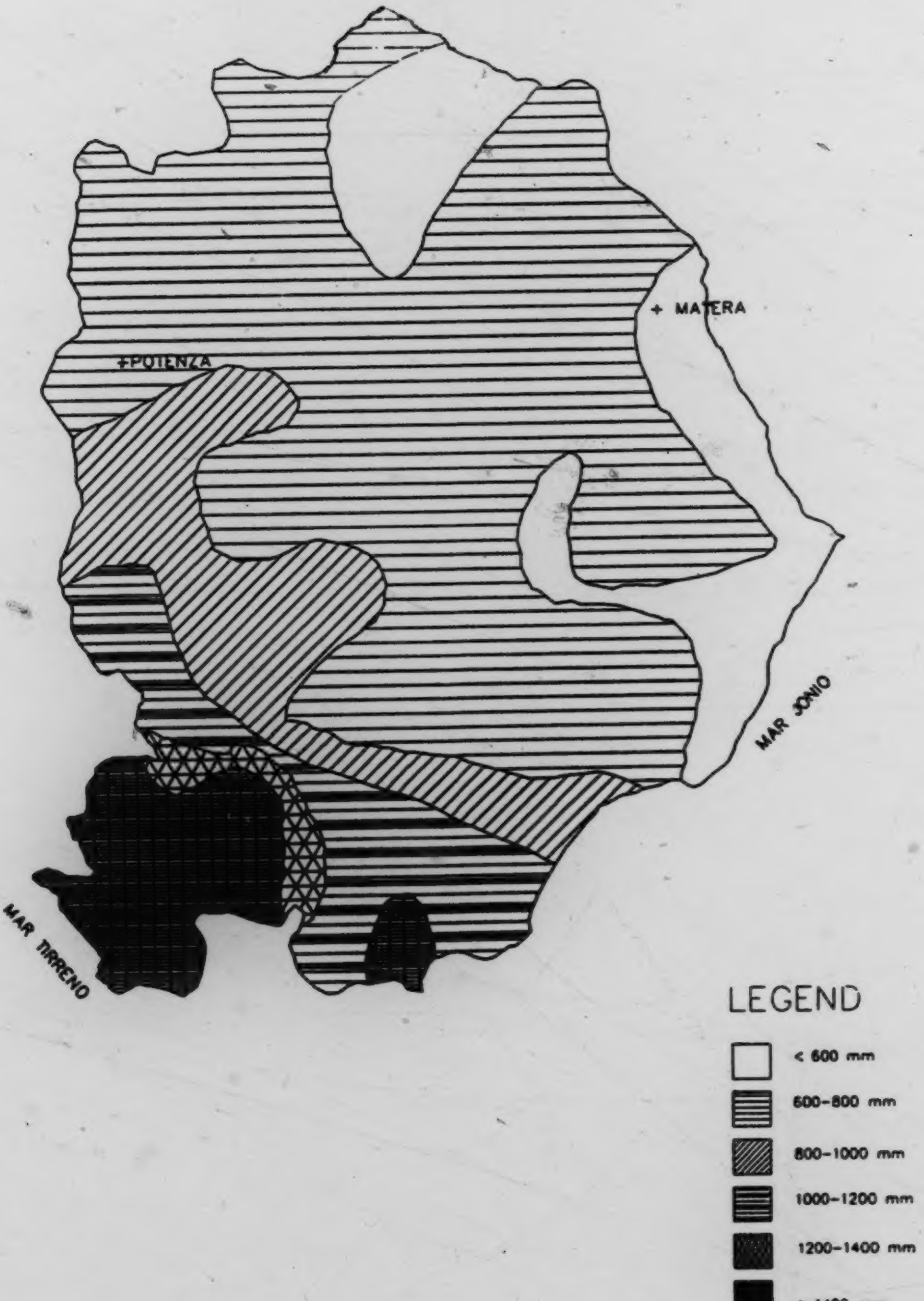
A significant proportion of the data were transcribed for me by Mr. Giuseppe Valentino of the Potenza Regional office, *Servizio Idrografico e Mareografico Nazionale, Presidenza del Consiglio dei Ministri*, from the *Annali Idrologici*.

Recent, unpublished data were sent to me by the offices concerned with the kind permission of Ing. Raffaele Niccoli of the Catanzaro office, and Ing. Pietro Zanframundi of the Bari office (*Servizio Idrografico e Mareografico Nazionale, Presidenza del Consiglio dei Ministri*).

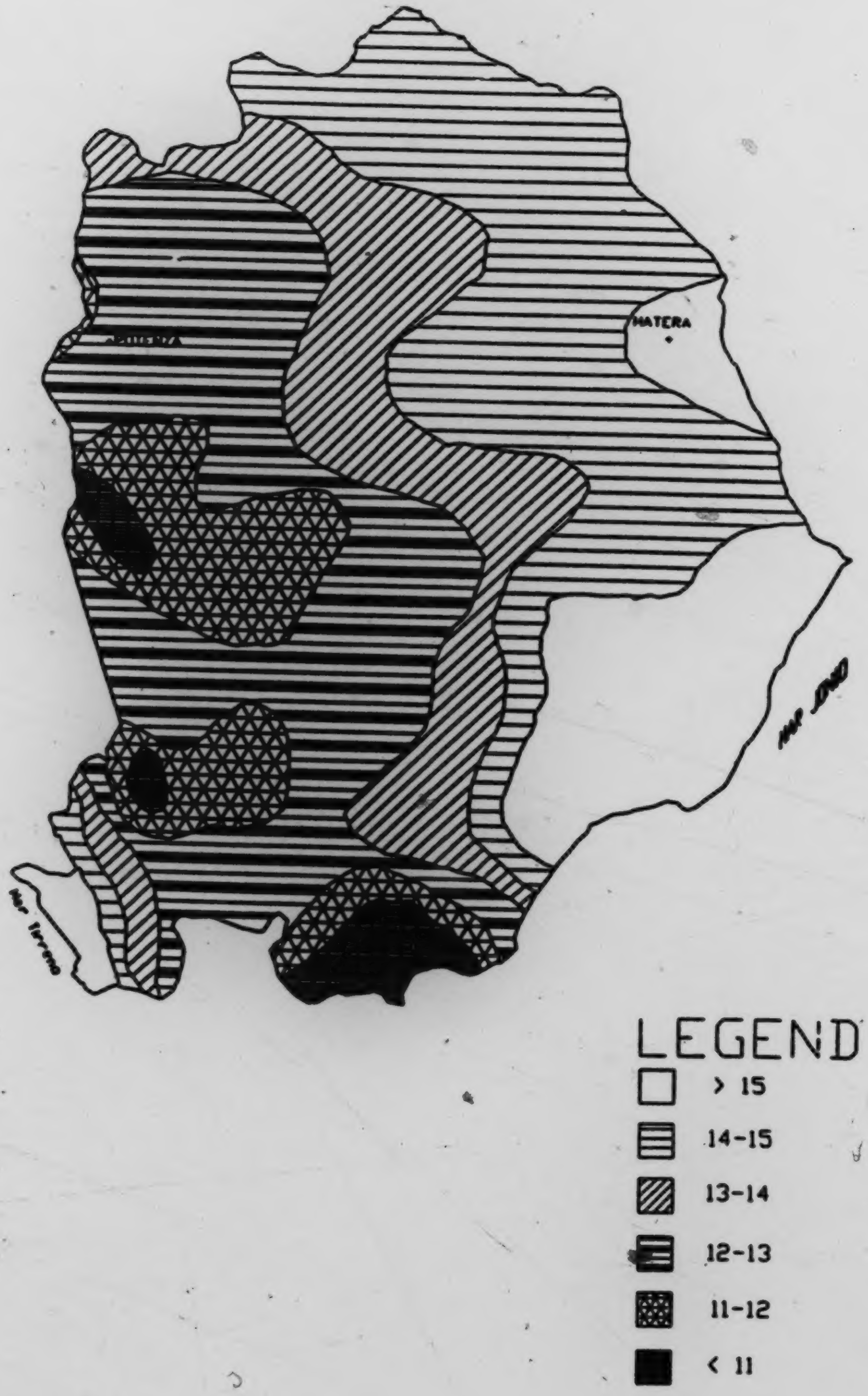
Appendix C: Figure C1
Mediterranean Basin Climate and Vegetation Boundaries
(Adapted from Cheylan (1991:fig. 17.1))


▨ Mediterranean shrubland
▧ Mediterranean bioclimate

Appendix C: Figure C2
Distribution of Average Precipitation in Basilicata (1921-1980)
(Adapted from Caloiero et al. (1993:37))

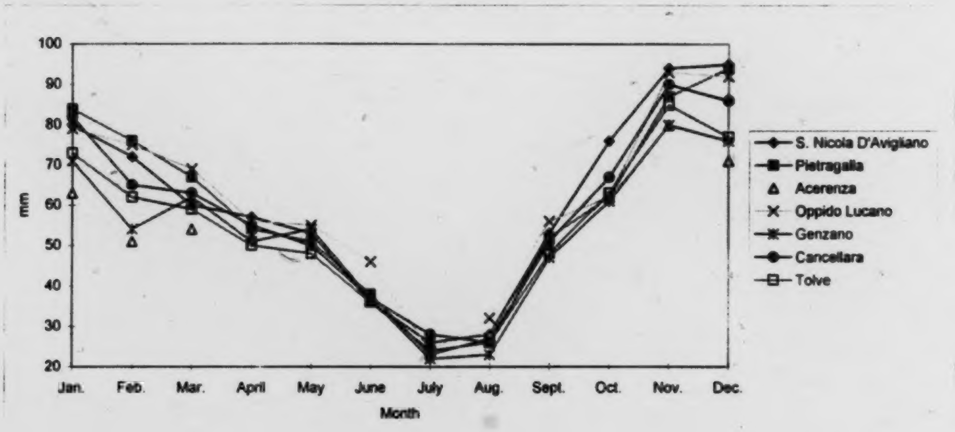

+ MATERA
+POTENZA
MAR JONIO
MAR TIRRENO
LEGEND
< 600 mm
600-800 mm
800-1000 mm
1000-1200 mm
1200-1400 mm
> 1400 mm

Appendix C: Figure C3
Distribution of Average Annual Temperature in Basilicata (1921-1980)
(Adapted from Caloiero et al. (1993:10))


POTENZA
MATERA
Mar Jonio
Mar Tirreno
LEGEND
> 15
14-15
13-14
12-13
11-12
< 11

Appendix C: Approximate 30 Year Precipitation Averages (mm) at Research Sites

Figure C4



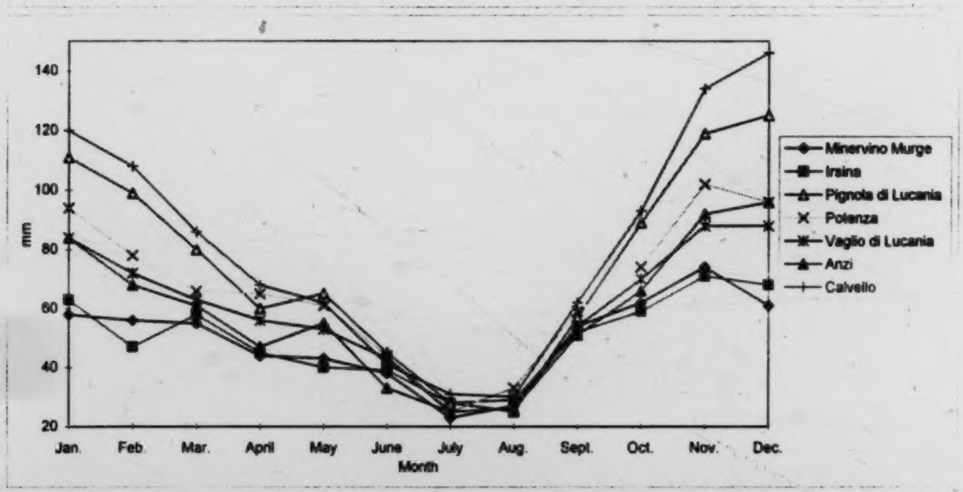
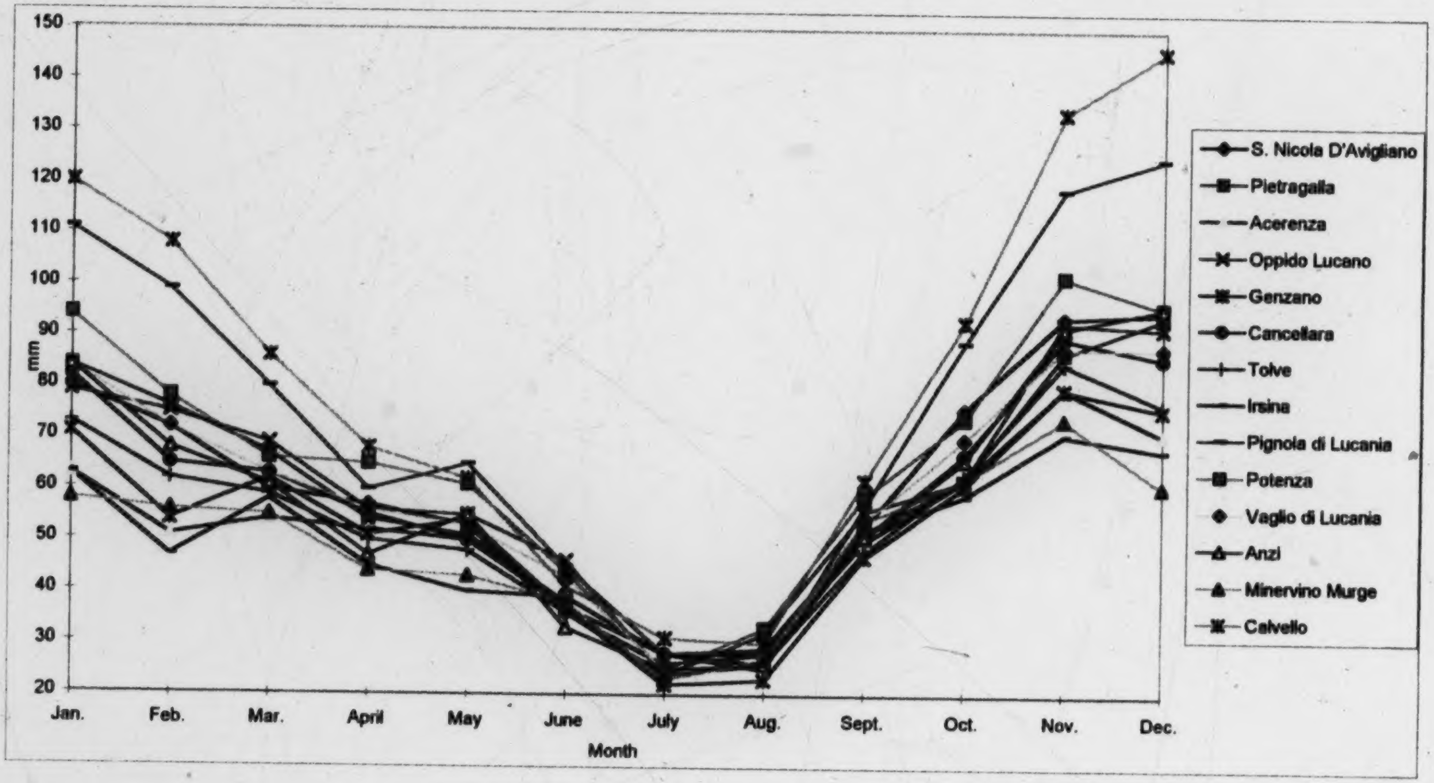


Table C1

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total mm
S. Nicola D'Avigliano	80	72	60	57	53	36	26	28	53	76	94	95	730
Pietragalla	84	76	67	54	51	38	23	27	52	62	87	94	715
Acerenza	63	51	54	52	50	37	28	28	50	62	80	71	626
Oppido Lucano	79	75	69	56	55	46	24	32	56	62	93	92	739
Genzano	71	54	62	51	54	37	22	23	47	61	80	76	638
Cancellara	82	65	63	55	50	37	28	26	51	67	90	86	700
Tolve	73	62	59	50	48	36	24	26	48	63	85	77	651
Irsina	63	47	58	45	40	39	28	29	52	59	71	68	599
Pignola di Lucania	111	99	80	60	65	45	28	25	57	89	119	125	903
Potenza	94	78	66	65	61	44	25	33	59	74	102	96	797
Vaglio di Lucania	84	72	63	56	53	43	25	26	54	70	88	88	722
Anzi	84	68	61	47	55	33	25	26	51	66	92	96	704
Minervino Murge	58	56	55	44	43	38	23	27	54	62	74	61	595
Calvello	120	108	86	68	62	41	31	30	62	93	134	146	981

APPENDIX C: Figure C5: Basilicata and Minervino Murge (Apulia) Monthly Precipitation Averages (mm) 1921-1980



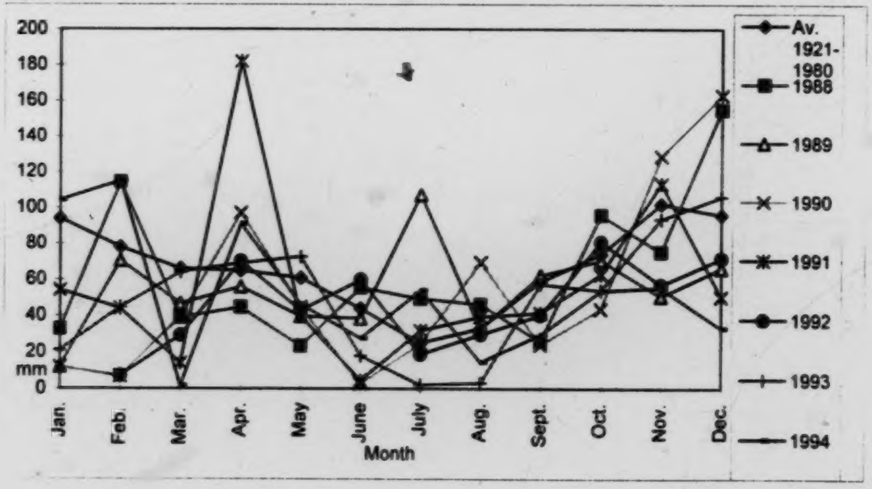
Appendix C: Potenza (Basilicata) Average Monthly Precipitation 1988-1994 Average (1921-1980) at 826 m a.s.l.

Table C2

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Av. 1921-1980	94.0	78.0	66.0	65.0	61.0	44.0	25.0	33.0	59.0	74.0	102.0	96.0
1988	32.7	114.3	39.0	44.6	23.4	55.6	49.4	46.2	25.8	95.8	75.2	155.0
1989	12.2	70.4	46.6	56.0	39.8	38.6	107.2	32.8	62.2	70.4	50.6	66.2
1990	11.8	6.8	39.4	97.2	44.8	2.6	24.6	69.6	24.0	43.6	129.0	163.2
1991	54.2	44.0	14.0	182.0	40.0	4.4	31.8	39.4	41.4	62.8	113.4	50.4
1992		7.0	29.2	70.2	43.0	59.8	18.8	29.6	40.2	80.8	57.0	71.6
1993	21.2	44.6	64.2	69.0	72.6	18.0	2.0	3.0	57.4	53.8	93.6	106.0
1994	104.2	115.0	1.6	91.0	46.4	27.6	53.8	14.4	29.4	53.6	55.4	33.2
Sum 1988-94	236.3	402.1	234.0	610.0	310.0	206.6	287.6	235.0	280.4	460.8	574.2	645.6
Av. 1988-94	39.4	57.4	33.4	87.1	44.3	29.5	41.1	33.6	40.1	65.8	82.0	92.2
St. dev. 1988-94	35.48	45.03	20.8	45.66	14.62	22.99	34.12	21.64	15.1	17.99	30.81	50.83

The variation about the mean is so great that averages have no predictive value. Although the sample is too small to produce statistical accuracy, the average for 1921 to 1980 when compared to that of 1988 to 1994, illustrates clearly the extreme variation in precipitation.

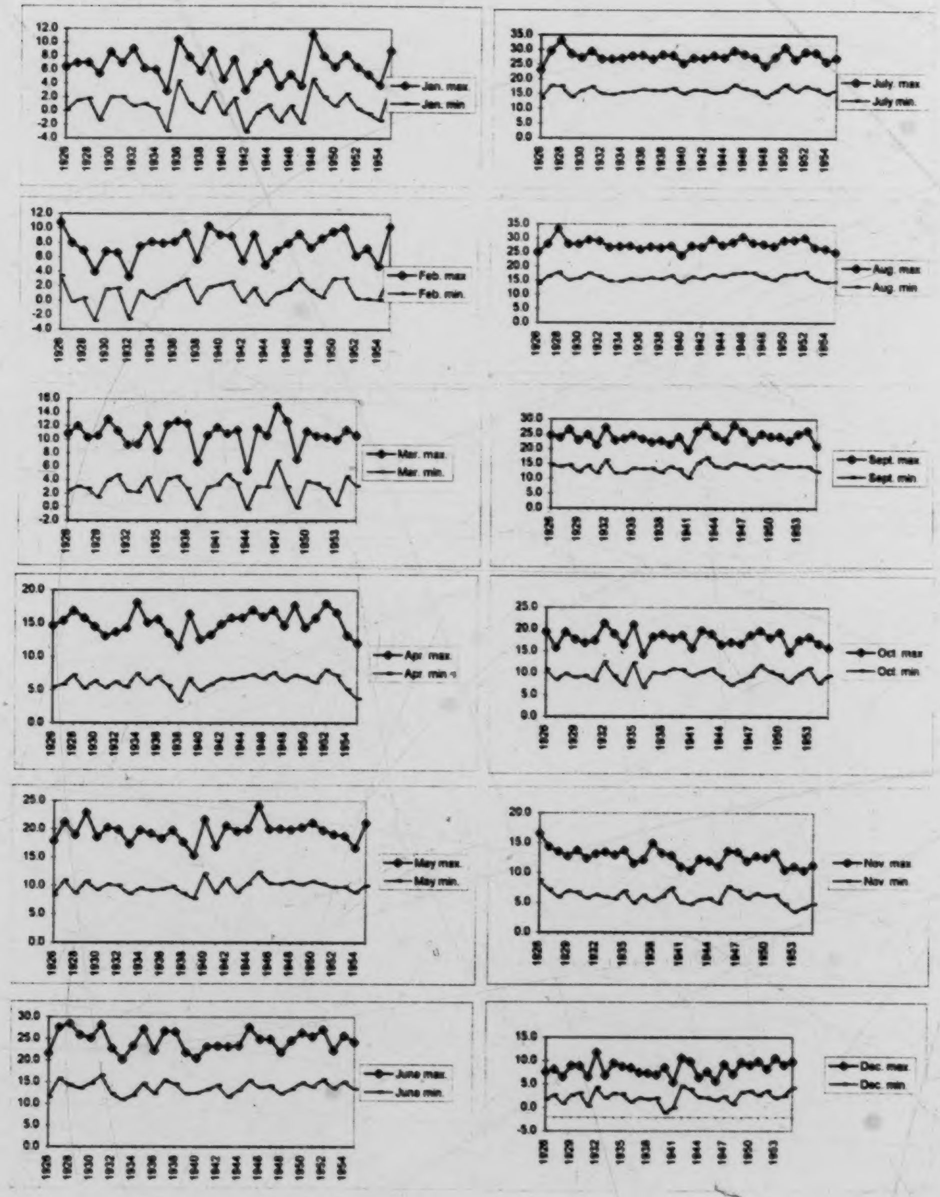
Figure C6



Appendix C: Table C3: Potenza (Basilicata) Average Monthly Maximum and Minimum Temperatures (°C) 1926-1980

	Jan. max.	Jan. min.	Feb. max	Feb. min.	Mar. max.	Mar. min.	Apr. max.	Apr. min.	May max.	May min.	June max.	June min.	July. max.	July min.	Aug. max.	Aug. min.	Sept. max.	Sept. min.	Oct. max	Oct. min.	Nov. max.	Nov. min.	Dec. max.	Dec. min.	Annual max.	Annual min.
1926	6.5	0.1	10.8	3.4	10.9	2.4	14.7	5.4	17.9	8.3	21.6	11.5	23.1	13.5	25.1	13.8	24.6	14.5	19.4	10.8	16.6	8.7	7.6	1.8	16.6	7.9
1927	7.0	1.5	8.0	-0.2	12.0	3.0	15.4	5.8	21.2	10.9	27.6	15.8	29.6	17.7	28.0	16.4	23.9	14.0	15.8	8.5	14.4	7.2	8.2	2.7	17.6	8.6
1928	7.1	1.8	6.9	0.3	10.3	2.7	16.9	7.2	19.0	8.6	28.5	14.3	33.2	17.6	33.4	17.9	26.6	14.5	19.4	9.8	13.6	5.9	6.6	0.9	18.5	8.4
1929	5.5	-1.4	4.0	-2.8	10.6	1.4	15.8	5.2	22.9	10.8	25.9	13.5	28.6	13.9	28.0	15.1	23.0	12.2	17.7	9.0	12.8	6.9	9.0	2.6	17.0	7.2
1930	8.6	2.0	6.8	1.5	13.0	3.9	14.5	6.3	18.6	9.2	25.2	14.6	27.3	16.1	28.0	15.8	24.8	14.3	16.9	9.3	13.8	6.7	6.9	3.1	17.2	8.6
1931	7.0	2.0	6.6	1.7	11.3	4.7	13.1	6.3	20.3	10.2	28.2	16.5	29.4	17.4	29.5	17.6	21.3	11.8	17.5	8.2	12.4	5.7	6.6	0.3	16.9	8.4
1932	9.1	0.7	3.3	-2.6	9.2	2.3	13.7	6.2	19.9	10.0	22.8	12.2	26.8	15.0	29.1	16.4	27.2	16.0	21.4	12.5	13.2	6.3	11.8	4.3	17.3	8.3
1933	6.2	1.0	7.5	1.3	9.3	2.2	14.3	5.4	17.4	8.5	20.2	10.9	26.8	14.6	26.8	14.7	22.9	11.8	19.0	9.3	13.5	5.9	6.9	2.0	15.9	7.3
1934	6.0	0.3	8.1	0.3	12.0	4.3	18.1	7.4	19.8	9.5	23.4	11.9	27.1	15.4	27.1	14.6	23.5	11.8	16.5	7.2	13.0	5.6	9.5	3.0	17.0	7.6
1935	2.9	-3.0	7.9	1.2	8.4	0.9	15.1	5.8	19.2	9.1	27.2	14.6	27.9	15.8	27.3	15.6	24.7	13.4	21.1	12.3	13.8	6.9	8.8	2.9	17.0	8.0
1936	10.4	4.3	8.1	2.1	12.2	4.1	15.6	7.0	18.3	9.3	22.3	12.3	28.1	16.5	28.2	15.2	23.4	13.2	14.3	6.7	11.6	4.9	8.5	1.2	16.6	8.1
1937	7.9	1.0	9.4	2.9	12.7	4.5	13.5	5.6	19.8	9.8	26.8	15.3	26.8	16.2	27.0	16.0	22.3	13.4	18.3	10.1	12.2	6.2	7.5	2.1	17.0	8.6
1938	5.8	-0.3	5.7	-0.4	12.4	2.7	11.5	3.3	17.7	8.6	26.6	14.5	28.3	16.2	26.6	15.5	22.9	12.0	18.9	9.9	15.0	5.2	7.4	1.8	16.6	7.5
1939	8.8	2.7	10.3	1.8	6.7	-0.3	16.4	6.7	15.4	7.7	21.8	12.2	28.0	16.8	27.3	16.7	21.6	14.0	18.0	10.9	13.3	6.0	7.0	2.0	16.2	8.1
1940	4.6	-0.5	9.1	2.2	10.6	2.9	12.6	4.9	21.7	12.1	20.5	12.4	25.3	15.0	23.9	14.4	24.0	13.1	18.7	10.8	12.9	7.4	8.6	-1.1	15.6	7.6
1941	7.5	1.6	8.9	2.6	11.6	3.3	13.3	5.6	16.9	8.7	23.2	13.2	27.2	16.3	27.3	16.3	19.5	10.1	15.7	9.4	11.0	5.0	5.5	0.0	15.6	7.7
1942	3.0	-3.1	5.5	-0.2	10.9	4.8	14.9	6.7	20.6	11.2	23.3	14.2	27.0	16.2	26.9	15.6	26.0	15.2	19.6	10.2	10.4	4.7	10.6	4.6	16.6	8.4
1943	5.7	-0.3	9.1	1.7	11.4	3.5	15.8	6.6	19.6	8.8	23.2	11.5	28.0	15.3	29.7	17.1	28.0	17.0	19.0	11.0	12.3	5.5	9.9	3.9	17.8	8.5
1944	7.0	0.8	4.9	-0.6	5.4	-0.3	15.8	6.9	20.0	10.3	23.4	13.1	27.3	15.8	27.5	16.4	24.4	14.0	16.5	9.3	12.0	5.7	6.5	2.2	15.9	7.8
1945	3.6	-1.6	6.9	1.0	11.7	3.0	17.0	7.3	24.1	12.4	27.6	15.3	29.7	16.1	28.6	17.5	22.9	13.6	17.1	7.3	11.1	4.9	7.7	2.1	17.3	8.4
1946	5.3	0.7	7.9	1.5	10.6	3.0	16.0	6.7	20.0	10.4	24.9	13.7	28.5	16.8	30.6	17.8	28.1	15.2	16.7	8.3	13.7	7.7	5.7	1.6	17.3	8.6
1947	3.7	-1.8	9.2	3.0	14.9	6.8	17.0	7.6	20.1	10.3	24.9	14.1	27.4	16.1	28.4	17.8	25.9	14.6	18.7	9.3	13.5	7.0	9.3	2.4	17.7	8.9
1948	11.2	4.6	7.3	1.4	12.7	3.0	14.7	6.4	19.9	10.7	21.9	12.3	24.4	13.9	27.9	16.2	22.7	13.3	19.7	11.8	12.0	5.7	7.2	0.8	16.8	8.3
1949	8.0	2.0	8.6	0.4	7.1	-0.1	17.7	7.2	20.3	10.2	24.6	13.3	27.6	15.9	27.1	16.2	26.1	14.4	18.1	10.4	12.8	6.5	9.7	3.3	17.3	8.2
1950	6.4	0.7	9.5	3.0	11.2	3.8	14.4	6.8	21.1	10.8	26.4	14.8	30.8	18.2	29.3	17.1	24.2	13.6	19.3	9.6	12.5	6.1	9.1	3.6	17.9	9.0
1951	8.2	2.5	10.0	3.1	10.5	3.5	15.8	6.1	19.8	10.3	25.5	13.9	26.7	15.9	29.4	17.3	24.2	14.6	14.8	7.9	13.4	6.3	9.9	2.7	17.3	8.7
1952	6.4	0.3	6.2	0.3	10.4	2.7	18.0	8.0	19.1	9.7	27.1	15.5	29.3	17.6	30.3	18.2	22.6	14.0	17.6	9.8	10.5	4.8	8.3	3.6	17.2	8.7
1953	5.3	-0.4	7.2	0.2	9.8	0.3	16.6	7.2	18.8	9.8	22.3	13.5	29.1	16.7	26.7	15.3	28.0	14.2	18.3	11.2	11.1	3.5	10.6	2.1	16.7	7.8
1954	3.8	-1.4	4.8	0.1	11.4	4.5	13.2	5.1	16.7	8.8	25.7	15.0	26.0	15.0	26.3	14.5	26.1	14.1	16.8	7.8	10.4	4.1	9.1	2.5	15.9	7.5
1955	8.8	4.1	10.2	3.7	10.6	3.1	12.0	3.7	21.1	10.0	24.3	13.4	27.3	16.4	25.1	14.6	20.9	12.4	15.8	9.5	11.3	4.8	9.9	4.2	16.4	8.3
Sum	197.3	21.1	226.7	33.9	322.1	86.6	453.4	185.6	587.2	295.0	736.9	409.3	832.6	482.1	834.4	482.6	722.5	410.3	536.8	288.1	380.1	177.8	251.9	69.2	506.5	245.0
Av.	6.2	0.7	7.1	1.1	10.1	2.7	14.2	5.6	18.4	9.2	23.0	16.3	26.0	15.1	26.1	15.1	22.6	12.8	16.8	9.0	11.9	5.6	7.9	2.2	16.8	7.7
St dev	2.1	1.9	1.9	1.6	2.0	1.6	1.7	1.1	1.8	1.1	2.3	1.4	1.9	1.2	1.9	1.2	2.0	1.4	1.7	1.5	1.4	1.1	1.5	1.3	0.7	0.5

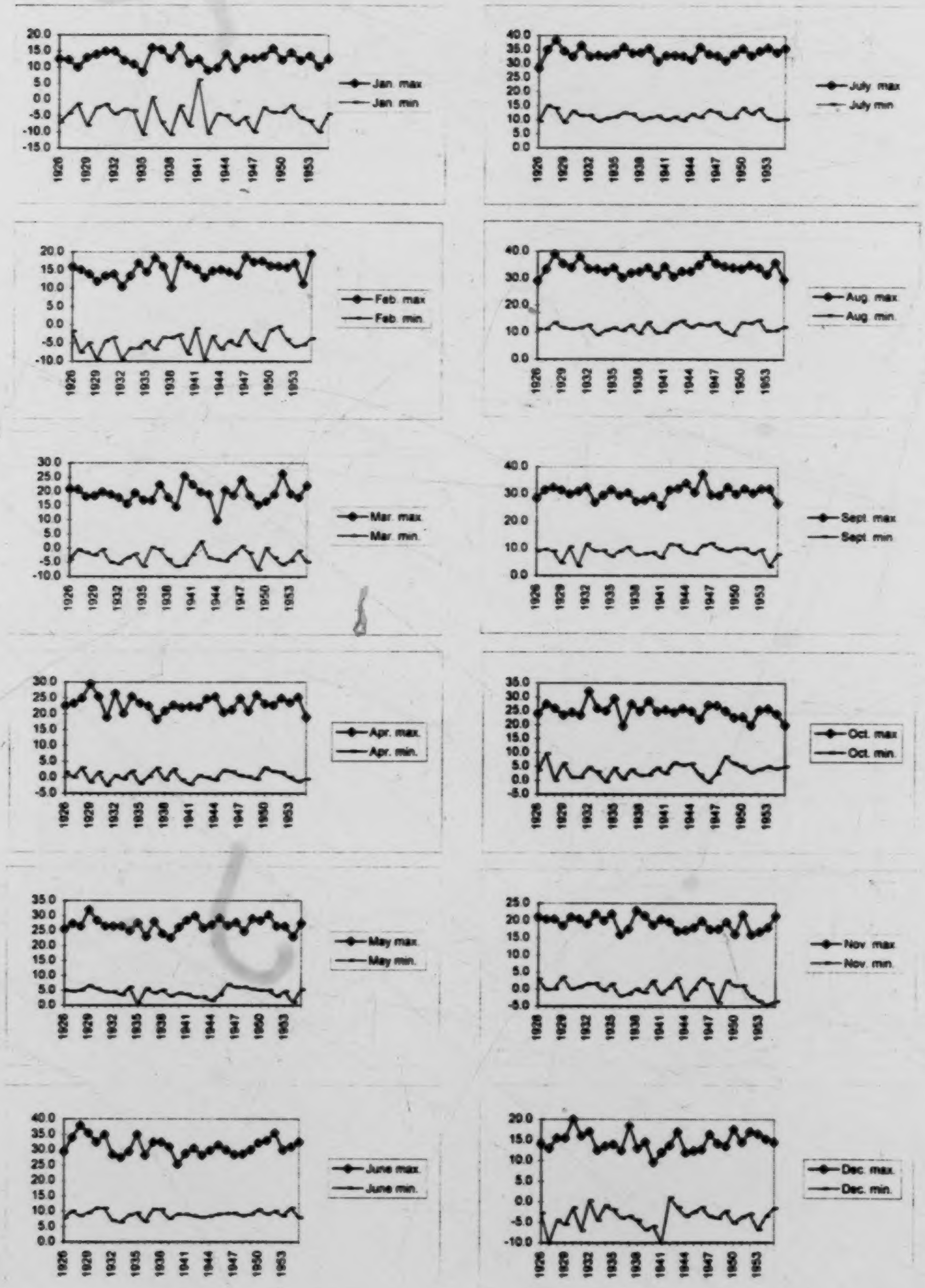
Appendix C. Figure C7
Monthly Average Temperatures (°C) at Potenza (Basilicata) 1926-1955



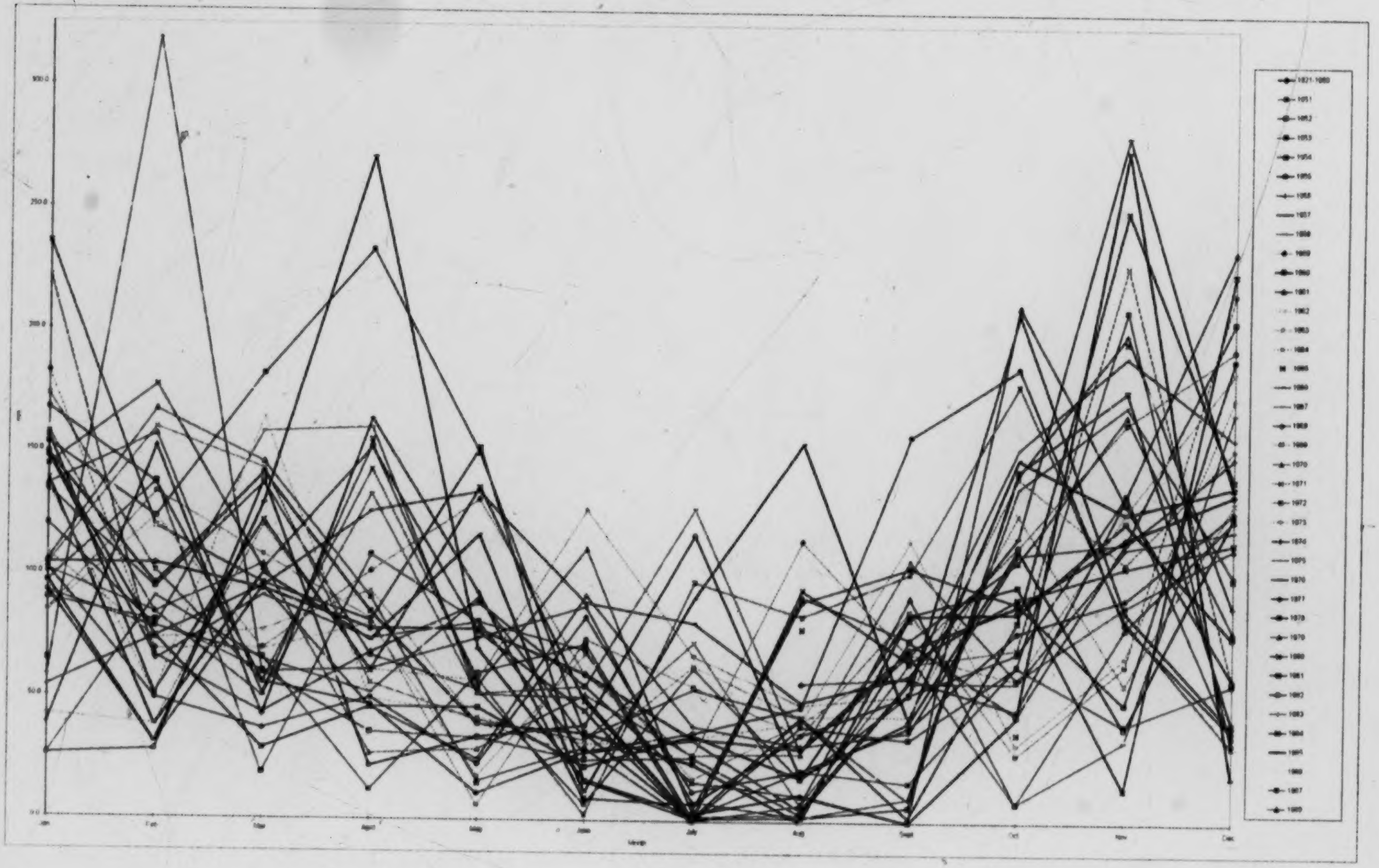
Appendix C: Table C4
Potenza (Basilicata) Extremes in Monthly Temperatures (°C) 1926-1980

	Jan. max.	Jan. min.	Feb. max.	Feb. min.	Mar. max.	Mar. min.	Apr. max.	Apr. min.	May max.	May min.	June max.	June min.	July max.	July min.	Aug. max.	Aug. min.	Sept. max.	Sept. min.	Oct. max.	Oct. min.	Nov. max.	Nov. min.	Dec. max.	Dec. min.
1926	12.6	-7.0	16.0	-1.8	21.0	-4.0	22.6	1.5	25.5	5.0	29.4	7.8	28.4	9.4	29.0	11.0	28.4	9.0	24.0	3.6	21.1	2.9	14.0	-2.8
1927	12.4	-4.2	15.2	-7.6	20.8	-0.8	23.4	0.0	27.4	4.6	34.0	10.0	35.0	15.0	33.4	11.0	31.5	9.6	27.5	9.5	20.4	-0.2	13.0	-10.0
1928	10.0	-1.4	14.0	-5.0	18.2	-1.6	25.0	3.0	26.5	5.0	36.0	8.5	38.5	14.0	39.0	13.5	32.5	9.0	26.0	0.0	20.5	0.0	15.5	-4.5
1929	13.0	-8.0	12.0	-9.5	18.5	-2.5	28.6	-1.5	32.0	6.5	35.6	9.5	34.5	9.0	35.5	11.5	31.5	4.5	23.6	6.0	18.5	3.5	15.5	-5.5
1930	14.0	-2.5	13.5	-4.5	20.0	-0.5	25.5	1.5	28.5	5.5	32.5	11.0	32.5	13.0	34.0	11.0	30.0	10.5	24.5	1.0	21.0	0.0	20.0	-1.5
1931	15.0	-1.5	14.0	-3.5	19.0	-6.0	19.0	-2.5	26.5	4.5	35.0	11.0	36.5	11.5	38.0	11.5	31.0	3.5	23.5	1.0	20.5	0.5	16.0	-7.0
1932	15.0	-4.5	10.5	-9.5	18.0	-5.5	26.5	0.5	26.5	4.5	28.5	7.0	32.5	11.5	33.5	12.5	32.5	11.5	32.0	4.5	19.0	1.5	17.0	0.2
1933	12.1	-3.0	13.5	-6.5	15.7	-3.5	20.2	-0.5	28.5	3.5	27.5	6.5	33.0	9.5	33.5	9.0	27.0	9.0	26.0	3.0	22.0	1.6	12.5	-4.5
1934	11.0	-3.5	17.0	-6.5	19.5	-2.0	25.5	2.0	25.0	6.0	29.5	8.8	32.5	10.5	32.5	10.5	29.5	9.2	25.0	-0.5	20.0	-0.5	13.5	-1.0
1935	8.5	-10.8	14.5	-4.5	17.0	-6.5	23.5	-2.0	27.6	0.3	35.0	9.4	33.5	11.0	34.0	11.5	31.6	7.0	29.5	4.2	22.0	1.5	14.0	-2.0
1936	16.0	0.5	18.5	-6.8	16.8	0.2	22.5	0.2	23.0	5.5	28.2	6.6	36.0	12.5	30.2	10.5	29.5	9.0	19.6	0.4	16.0	-2.0	12.5	-4.0
1937	15.5	-7.0	16.0	-3.5	22.4	-0.5	18.2	2.8	28.0	4.0	32.5	10.5	33.8	12.0	32.0	12.5	30.5	10.5	27.5	3.8	17.6	-1.5	18.5	-3.5
1938	12.6	-10.9	10.2	-3.6	18.0	-4.0	21.0	-0.8	24.0	5.0	32.5	10.5	34.0	10.0	32.5	9.5	27.4	7.6	25.0	1.8	23.0	0.0	13.0	-4.5
1939	16.5	-2.0	18.4	-2.8	14.6	-6.5	22.8	2.5	22.6	3.0	31.0	7.6	35.5	10.7	34.0	13.6	27.8	8.0	28.6	2.0	21.5	-1.0	14.6	-6.8
1940	11.2	-8.2	16.5	-8.0	25.5	-6.0	22.0	-0.8	26.2	4.0	25.3	9.0	30.8	11.4	31.0	9.7	29.0	8.5	24.8	4.4	18.8	2.4	9.6	-6.0
1941	12.5	6.0	15.5	-1.0	22.5	-2.3	22.4	-2.2	28.5	3.7	28.8	9.0	33.0	10.0	34.4	10.0	25.7	6.5	25.5	2.5	20.4	-1.5	12.0	-10.0
1942	9.0	-10.5	13.0	-9.5	20.0	2.3	22.1	0.5	30.0	2.7	30.5	8.5	33.0	11.0	30.6	13.0	31.5	11.5	24.5	6.3	19.6	0.4	13.7	1.0
1943	9.8	-4.6	14.8	-3.2	19.0	-3.4	24.8	0.0	25.9	2.8	28.2	8.0	32.8	9.8	32.6	14.2	32.0	11.2	26.0	5.5	17.0	3.2	17.0	-1.4
1944	14.0	-5.0	15.2	-6.7	9.8	-4.0	25.5	-0.8	27.0	1.5	29.8	8.4	31.5	12.0	32.6	11.8	34.0	8.5	25.0	6.0	17.2	-3.1	12.0	-3.5
1945	9.5	-7.8	14.5	-4.4	20.4	-4.8	20.6	2.1	29.2	3.6	31.5	9.0	36.0	10.9	35.0	13.0	30.6	8.0	22.0	2.0	18.0	0.0	12.4	-2.5
1946	12.8	-5.6	13.6	-5.8	18.6	-2.0	21.3	1.8	26.7	7.0	30.0	9.2	33.6	13.5	38.2	12.5	37.4	11.1	27.1	-0.6	19.9	3.1	12.7	-1.4
1947	12.8	-10.1	18.6	-1.5	24.0	0.8	24.9	0.5	27.8	6.0	28.4	9.3	33.0	12.7	35.6	13.5	29.7	11.9	27.0	2.5	17.5	1.5	16.4	-3.6
1948	13.3	-2.6	17.2	-5.2	18.6	-1.8	20.9	0.2	24.8	6.1	28.6	8.5	31.2	10.5	34.5	10.1	29.5	9.8	25.1	6.5	17.6	-4.0	14.2	-4.0
1949	15.8	-4.0	17.5	-7.0	16.3	-7.8	28.0	-0.6	29.0	5.4	30.0	8.9	33.6	10.8	34.0	9.0	32.6	9.0	22.7	6.2	19.6	2.5	13.5	-2.3
1950	12.3	-4.0	16.2	-1.5	16.5	0.0	23.2	3.0	28.4	5.0	32.2	10.4	35.5	14.2	33.6	13.6	30.0	10.0	23.0	5.0	16.1	1.0	17.6	-5.2
1951	14.5	-1.9	16.1	-0.5	19.0	-3.4	22.8	1.9	30.4	5.0	33.0	9.0	33.0	12.1	35.0	13.3	32.0	10.0	19.8	2.9	21.7	1.0	14.5	-3.8
1952	12.1	-5.6	15.8	-4.0	26.3	-5.8	25.0	1.5	26.5	3.0	35.5	10.0	34.6	14.0	34.0	14.5	30.4	8.0	25.4	3.9	16.0	-2.1	17.0	-3.0
1953	13.5	-6.5	17.0	-6.0	19.2	-4.5	23.6	0.0	28.5	4.6	30.0	8.5	35.8	10.5	31.5	10.5	32.0	9.8	25.9	5.0	16.8	-3.5	16.5	-6.8
1954	10.1	-10.0	11.3	-5.5	18.0	-1.0	25.3	-1.3	23.0	1.0	31.0	11.0	34.1	10.0	35.9	10.6	32.0	3.5	24.0	4.2	18.0	-4.6	15.2	-3.5
1955	12.8	-4.5	19.5	-3.8	22.0	-4.9	19.0	-0.5	27.5	5.3	32.6	8.0	35.6	10.3	29.7	12.0	26.6	7.9	20.0	5.0	21.5	-3.6	14.5	-1.6
Sum	379.8	-150.6	455.6	-149.2	574.2	-90.9	694.6	12.0	807.0	129.5	934.5	269.4	1013.3	343.3	1009.3	350.4	915.7	262.9	750.0	109.6	578.8	-1.0	438.4	-115.0
Av.	12.7	-5.0	15.2	-5.0	19.4	-3.0	21.7	0.4	26.9	4.3	31.2	9.0	33.8	11.4	33.6	11.7	30.5	8.8	25.0	3.6	19.3	0.0	14.6	-3.8
St dev.	2.1	3.7	2.4	2.5	3.3	2.4	2.5	1.6	2.2	1.6	2.9	1.2	2.0	1.6	2.4	1.6	2.4	2.1	2.7	2.5	2.0	2.3	2.2	2.6

Appendix C: Figure C8
Monthly Temperature Extremes (°C) at Potenza (Basilicata) 1926-1955



Appendix C Figure C8
[illegible] (Basilicata) Monthly Precipitation Averages
1951-1989 Average (1921-1980) at 910 m a.s.l



Appendix C: Cancellara (Basilicata) Average Monthly Precipitation Values at 620 m a.s.l.

Table C5

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Totals
mm 1981	70.5	43.5	4.7	9.2	19.4	7.8	18.3	27.5	13.1	39.5	12.6	59.5	325.6
# days	11	9	2	4	5	2	4	5	4	7	4	11	68
mm 1982	25.2	29.5	60.0	11.8	5.8	20.0	7.1	10.0	28.0	54.5	22.0	38.7	312.6
# days	7	6	13	5	3	4	4	3	5	6	5	9	70
mm 1983	14.9	97.1	26.0	12.0	6.0	22.7	22.8	30.0	23.0	50.0	36.5	100.0	441
# days	3	11	5	5	2	9	3	4	5	7	10	15	83
mm 1984	85.5	65.0	67.1	59.3	24.3	13.0	0	18.5	46.2	28.0	64.5	60.0	531.4
# days	8	10	14	12	6	3	0	6	7	6	8	12	91
mm 1985	127.3	23.5	95.8	53.0	17.8	0	0	0.5	1.5	28.5	79.6	3.0	430.5
# days		5	15	6	4	0	0	0	1	9	11	1	
mm 1986	31.5	68.3	58.3	12.5	38.3	86.6	6.8	6.5	19.8	14.4	23.1		
# days	10	13	9	4	5	8	3	2	5	3	5		
mm 1987	52.3	81.0	28.6	2.0	31.5	21.8	15.0	0	28.4	24.7	45.3	13.7	344.3
# days	11	10	10	1	5	5	3	0	4	4	9	6	67

These data were transcribed for me by Mr. G. Valentino of the Potenza Section, Servizio Idrografico e Mareografico (Presidenza del Consiglio dei Ministri) from the *Annali Idrologici*, *Sezione Autonoma del Genio Civile con Sede in Catanzaro per i Bacini con Foce al Litorale Jonico e Tirrenico dal Bradano al Lao.* Published for the Ministero dei Lavori Pubblici, Servizio Idrografico, by the Istituto Poligrafico dello Stato (Libreria): Rome.
As can be seen from the table, the data were incompletely reported, and some are approximate.

Table C6: 1921-1980 Cancellara Precipitation Averages

1921-80*	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Totals
mm	82	65	63	55	50	37	28	26	51	67	90	86	700
# days	10	8	9	7	7	5	3	3	6	8	10	10	86

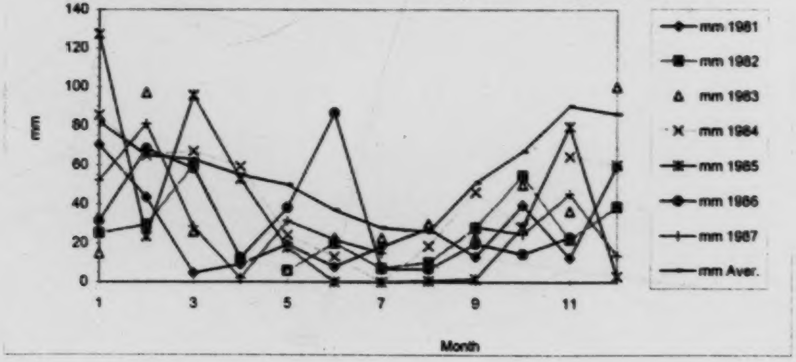
*Source: D. Caloiero, R. Niccoli, C. Reali. 1993. *Le Precipitazioni in Basilicata (1921 - 1980)*. *Consiglio Nazionale delle Ricerche, Istituto di Ricerca per la Protezione Idrogeologica nell'Italia Meridionale ed Insulare: Cosenza, p. 34 (above), 22 (below).*

1921-80*	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Totals
Max. mm											282		1053
Year											1955		1956
Min. mm						various	0						264
Year													1977

Table C7: Data for Graph from 1981-1987 & Averaged Values from 1921-1980

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
mm 1981	70.5	43.5	4.7	9.2	19.4	7.8	18.3	27.5	13.1	39.5	12.6	59.5
mm 1982	**25.2**	**29.5**	**60.0**	**11.8**	**5.8**	**20.0**	**7.1**	**10.0**	**28.0**	**54.5**	**22.0**	**38.7**
mm 1983	14.9	97.1	26.0	12.0	6.0	22.7	22.8	30.0	23.0	50.0	36.5	100.0
mm 1984	**85.5**	**65.0**	**67.1**	**59.3**	**24.3**	**13.0**	**0**	**18.5**	**46.2**	**28.0**	**64.5**	**60.0**
mm 1985	127	23.5	95.8	53.0	17.8	0	0	0.5	1.5	28.5	79.6	3.0
mm 1986	**31.5**	**68.3**	**58.3**	**12.5**	**38.3**	**86.6**	**6.8**	**6.5**	**19.8**	**14.4**	**23.1**	
mm 1987	52.3	81.0	28.6	2.0	31.5	21.8	15.0		28.4	24.7	45.3	13.7
mm Aver.	**82**	**65**	**63**	**55**	**50**	**37**	**28**	**26**	**51**	**67**	**90**	**86**

Figure C10: Cancellara Monthly Precipitation Averages 1981-1987 & Average (1921-1980)



Appendix C: Ruoti, Tolve and Vaglio (Basilicata) Average Monthly Precipitation

Figure C11: Ruoti (Basilicata) Average Monthly Precipitation 1982-1986 at 750 m a.s.l.

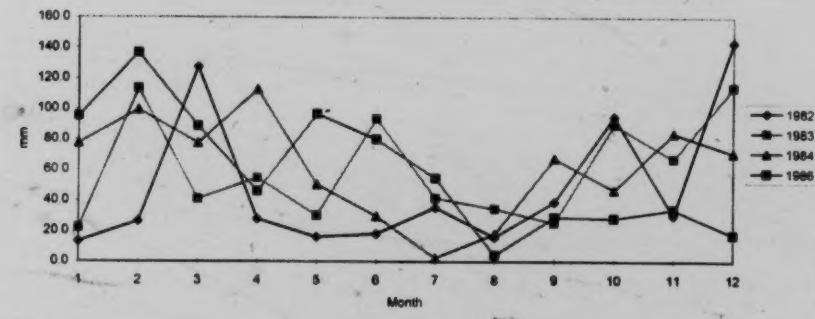


Figure C12: Precipitation at Tolve
1981-1987 & Average 1921-1980

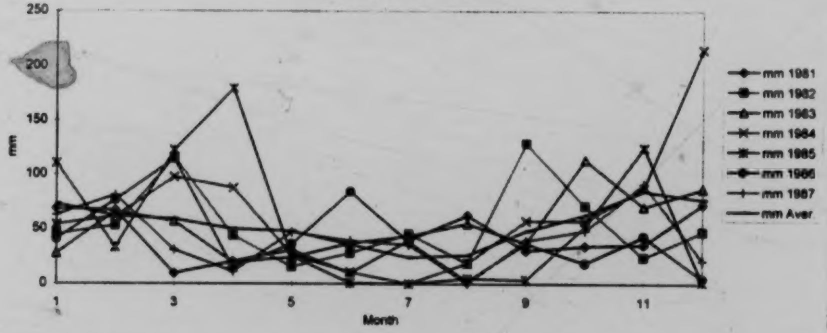
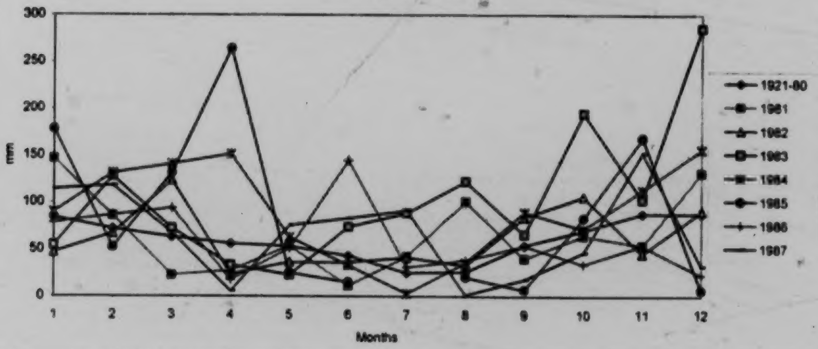


Figure C13: Vaglio di Lucania (Basilicata) Monthly Precipitation Averages 1981-1987 & Average (1921-1980) at 933 m a.s.l.



Appendix C: Bella and Irsina Monthly Precipitation Averages

Figure C14: Bella (Basilicata) Average Monthly Precipitation 1982-1984, 1986-1988 at 660 m a.s.l.

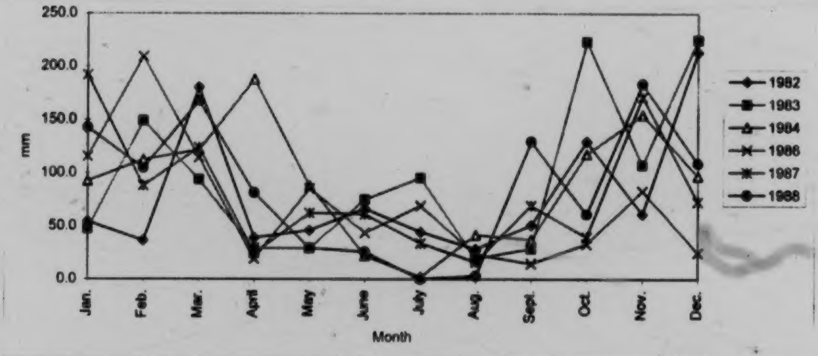
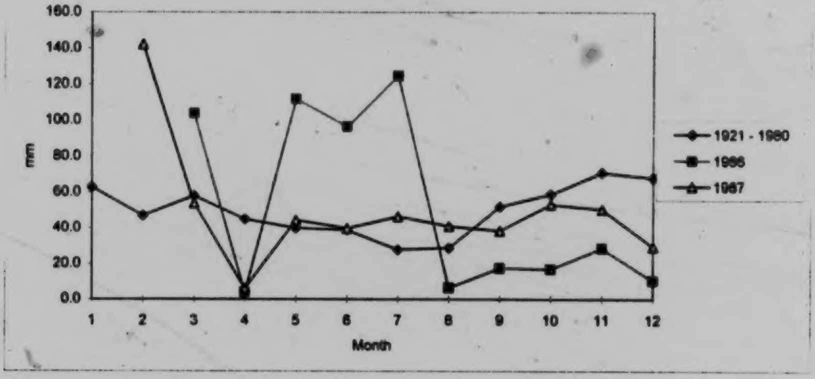
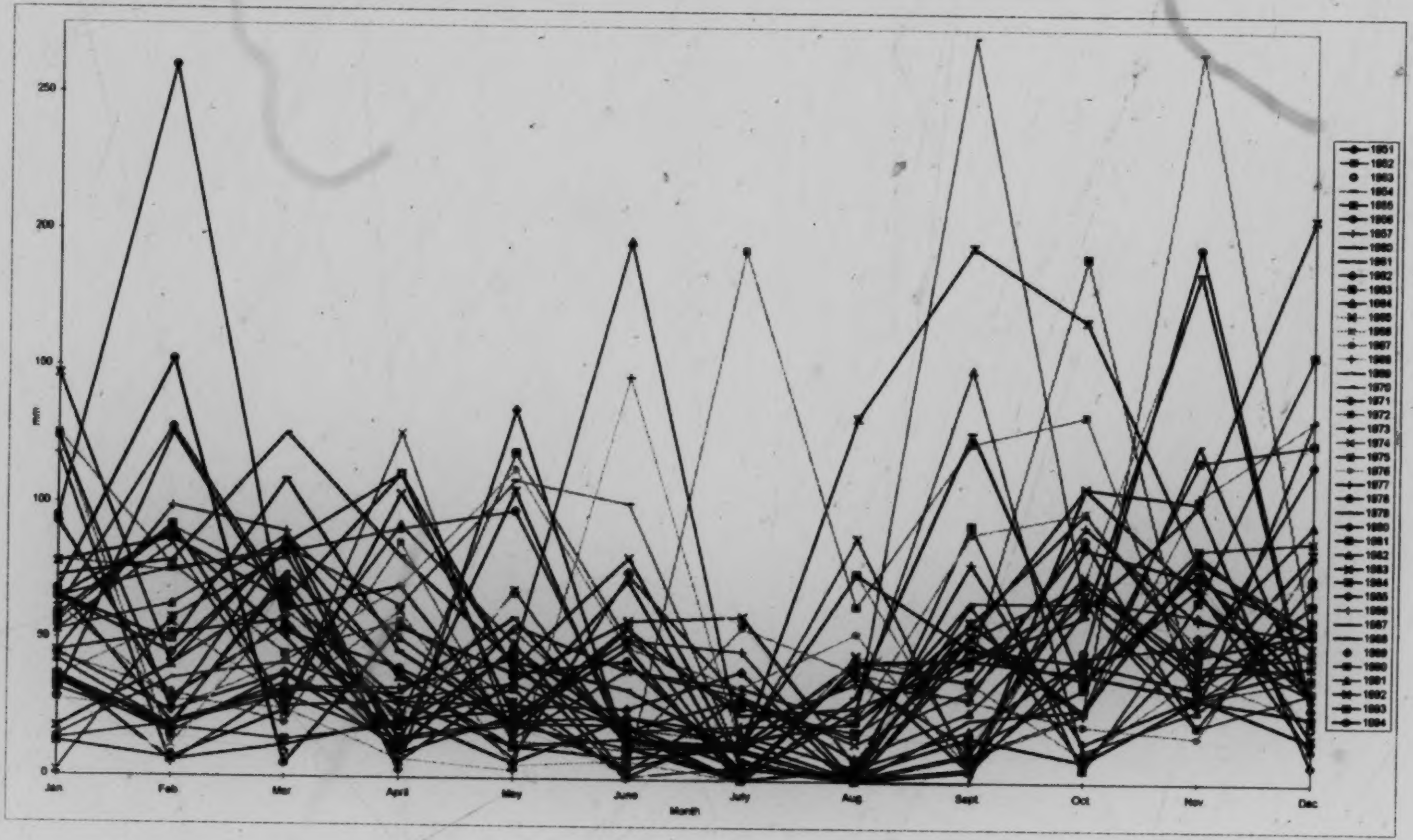


Figure C15: Irsina (Basilicata) Monthly Precipitation Averages 1986-1987 & Average (1921-1980) at 549 m a.s.l.

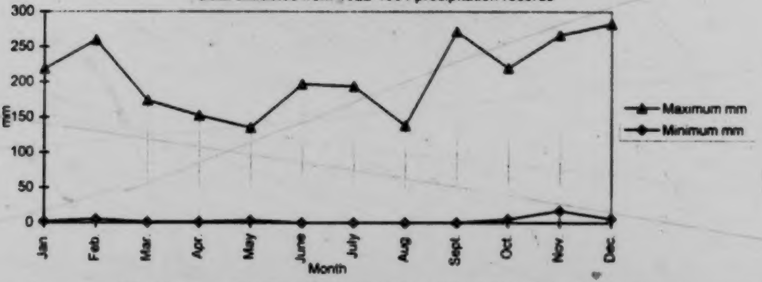


Appendix C Figure C16
Monthly Average Precipitation Minervino Murge: 1951-1994 Data



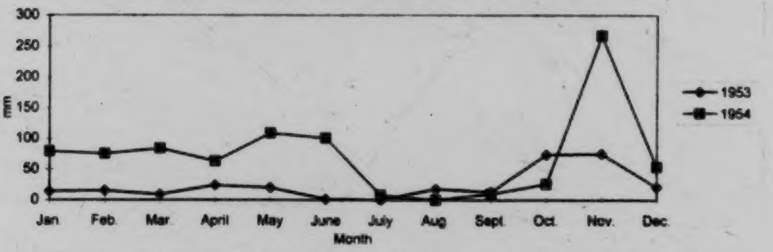
Appendix C: Minervino Murge Precipitation Variations

Figure C17: Variation in Monthly Precipitation at Minervino Murge (Apulia)
Data extracted from 1922-1994 precipitation records

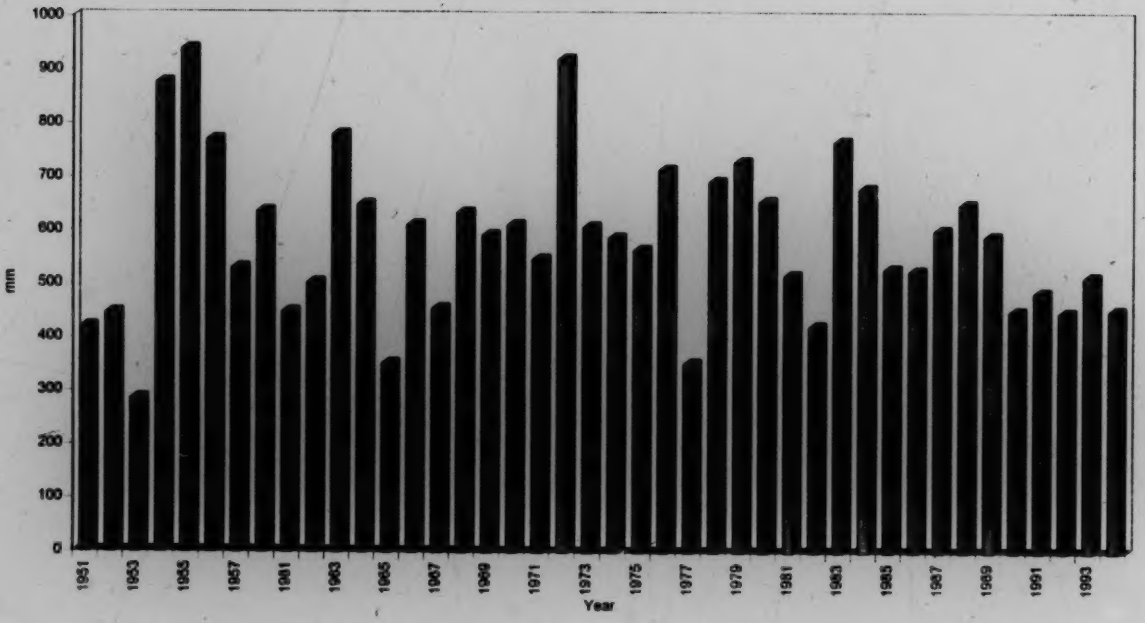


The chart above illustrates the amount of inter-annual variation in precipitation for one community, Minervino Murge, Apulia. From the 70 year data, the greatest amount of monthly precipitation is contrasted with the lowest values for the same month. The great variation is rendered even more clear in the chart below, contrasting two consecutive years' measurements also at Minervino Murge.

Figure C18: Sample Years: Variability in Monthly Precipitation at Minervino Murge (Apulia)



Appendix C: Figure C19
Minervino Murge (Apulia) Annual Total Precipitation 1951-1994 at 445 m a.s.l.
(average 596 mm)



APPENDIX D
ECONOMIC HISTORIES OF REPRESENTATIVE INFORMANTS

- The informant was born 1923 to a mixed farming family. The farm property was inherited from the grandfather (b.1860) who purchased this property of 20 hectares. The household also owns other 8 hectares, inherited through the informant's wife. They have always kept sheep (*c.*120) and goats (*c.* 20) as well as 8-10 cows.

- Born 1920, the informant farmed 3 hectares under the sharecropping (*mezzadria*) system and rented an additional 3 hectares. The informant kept neither sheep nor cows, and only a single goat (for milk) and a pig or two for household consumption. The household worked their property with an ass. They still keep a mule.

- Born 1910, his father died when the informant was 5 years old. The informant worked as a hired *pastore* with sheep (involved in transhumance for 3 months/year), and as a mixed farmer. His grandfather and great-grandfather were also mixed farmers in this same zone.

- Born 1925, the informant's parents were *mezzadri*. His father kept pigs and cattle as well as mules for ploughing, but neither sheep nor goats. Now retired, the informant still works his land. The family property consists of a number of small fields inherited through his father (divided among the sons). Of the small fragments of owned land, some are rented, some are farmed by him.

- Born 1916, the informant, his father and grandfather were all mixed farmers, keeping sheep and goats. The informant inherited *c.* 5 hectares. His grandfather owned *c.* 10 hectares, and his father purchased some 5 hectares more which were divided equally among the sons, each receiving 5 hectares. The informant kept a mixed herd of sheep and goats, totalling *c.* 100 head (60:40 goat-sheep ratio).

- Born 1912, the informant is one of 8 brothers who jointly held *c.* 300 sheep and 30-40 goats. The brothers rented land from the municipality described as a "clean area" (*"luogo pulito"*), that is, unforested, a large proportion of these were untilled pasture. They cultivated some land to hard wheat for household consumption, but farm production was primarily geared to the production and sale of cheese and meat (kids and lambs).

- Born 1929, the informant is the widow of a mixed farmer. The father of the informant's husband owned *c.* 5 hectares which were divided between the two sons. Now the widow's children have divided the *c.* 2.5 hectares between them. The household kept *c.* 100 head sheep and goats (*c.* 80 sheep and 20 goats). The land remains under cultivation using industrial inputs. Where the area bordering the farm was untilled pasture, it is now nearly all tilled.

- Born 1905, the informant was always a mixed farmer, as were his father and grandfather before him. He, his father, and two older brothers owned communally (*in società*) 300-400 sheep and *c.* 100 goats, numerous cattle and between 30-50 pigs until 1942 when his father died and the family began to feud. The informant was left to manage the farm. While the informant's grandfather was alive, 120 hectares were worked *in società*. This property was divided among the 3 brothers (father and 2 uncles), each receiving 40 hectares, of which the informant has inherited 16. Currently, the informant's sons cultivate according to the traditional rotation, except less land is sown to hay because they now keep fewer sheep and goats, and more is sown to hard wheat.

- Born 1923, the grandfather and father of the informant were both mixed farmers. After WWII, the informant returned to work on the family farm. With poor economic prospects at home, he spent 10 years working in France and in North Italy. The informant inherited 5 hectares from his father, and kept *c.* 100 sheep, 10 goats and *c.* 7 cows.

- Born 1930, the informant's father was a farmer, his grandfather raised sheep and goats, whereas the informant is a mixed farmer. The informant's grandfather kept between 1700-2000 sheep and 100-150 goats. For the winter, his grandfather engaged in transhumance, leaving the farm in November for the Apulian plains, but also below Acerenza, and as far north as Buccino (Province of Salerno) and returning to the mountain in May. During the summer, this huge flock was grazed in untilled pastures (which the grandfather burned before leaving with the flock in the autumn) and on bare fallow. They also made use of the *pandone* where the animals were penned at night (*cortiglia*) -- the resultant spontaneous pasture made luxurious grazing. The informant's father was a farmer cultivating hard wheat, legumes (chick peas and fava beans), legumes for feed (vetch and *favini*), corn, oats and barley (also for feed). Some of the informant's property was inherited (from his grandfather), additional lands have been purchased. The land is currently cultivated using industrial methods. The informant maintains a flock of *c.* 500 sheep, *c.* 50 goats, and also 50 cows for milk and meat.

- The informant was born 1916 to a mixed farming family. Always mixed farmers, the family cultivated 7 hectares under *mezzadria*. The household kept *c.* 80 sheep and *c.* 20 goats, 10 Podolian-breed cows, and 5 or 6 pigs for household consumption and for sale. Currently the household is engaged only in farming using industrial cultivation techniques (with the exception of keeping pigs for sale and household consumption).

- The family has worked on the same farm for several generations. In the family tradition, the two brothers continue to engage in mixed farming, managing a flock of *c.* 200 head sheep and *c.* 20 goats. The informants' great -grandfather rented this *masseria* under the *mezzadria* system. The informants' grandfather was a hired hand working on this same farm. When he married he purchased 100-200 sheep and lived off this flock. The informants' father also kept 100 sheep. Only recently did the brothers buy this *masseria* from the ex-*latifondisti* owners.

- Born 1931, this mixed farmer worked in Germany for seven years. The informant's family worked as hired labourers in the past, then as *mezzadri* at the current location beginning with his grandfather. The informant's father purchased the property which is worked jointly by both brothers. Have 350 sheep and *c.* 50 lambs and 10 goats. The property is tilled. 40 hectares of the 73 they own are sown: 26 hectares are under hard wheat, 2 are under barley and 2 are cultivated to oats. 10 hectares were also sown to clover which failed to germinate because of an extended drought (September through January); the informant sowed barley in this land in its place.

- Born 1913, the informant worked as an agricultural labourer on the Bradano plain all his life, almost exclusively on a mixed farm of *c.* 300 hectares with *c.* 100 sheep.

- Born 1925, the informant worked as an agricultural labourer and small farmer. For 25 years, he worked in France and Germany. When he returned, he worked on rented land in a cooperative, sharing plough animals. The informant inherited a little land, and purchased 3 hectares with money accumulated from working outside of Italy.

- The informant's family always worked this farm as *mezzadri*, under a perpetual lease arrangement (emphyteusis). The farm was later purchased by the informant's father and is currently jointly owned with his brothers, although the informant runs the mixed farm by himself. His flock is composed of 140 total head: *c.* 110 sheep and 30 goats. Production on this *masseria* is geared to the sale of cheese, kids and lambs on the local market.

- The informant (*c.* 60 years old) completed the third grade before he was pulled out of school to work as a *pastore* for a large landowner in exchange for room and board. He worked for a number of other large landowners in the area, mostly as a *pastore*, but also as an agricultural labourer. With the land reform, farming and livestock subsidies, he purchased the current farm.

- Born 1920, the informant always worked in agriculture although for 20 years worked road construction on the side. During WWII he fought at the French front and in Greek Albania. For two years he was a prisoner of war, returning home in 1944. The informant married in 1948 after which he worked as a day labourer and as a hired hand. The informant also rented land which he worked through a cooperative, pooling labour and animals.

- Born in 1924, the informant began to work on the family farm at 11 years of age. His father purchased a farm jointly with two cousins in 1929. The area at the time was heavily wooded with large oaks. The previous proprietor grazed a great number of Podolian-breed cattle on this land. When the informant's father purchased the property, he cut the forest and put in wheat under the typical rotation and purchased *c.* 200 sheep. The family worked *in società* (cooperatively), and purchased other lands which they then lost due to a succession of years of drought. The informant left the farm over disagreements with his father regarding how it was run. After marrying, he worked at all sorts of jobs in Germany. Through inheritance, the land was divided among the sons when they married. The family size was such that only 3 hectares and a mule were provided to each son. The inherited portion, for the last three years, has been left fallow because it is too small to justify the expense of hiring a tractor to cultivate it.

- The informant's family kept pigs and goats. As a boy, he was sent to graze pigs at night on stubbles and under the oaks along the Bradano. During the day he (and the pigs) slept in the cool forest alongside the Bradano river. Almost twenty years ago, the informant switched to sheep because a large proportion of the pig feed came from grazing fallen grain heads among the stubbles which, with combines, have been greatly reduced, and there is now insufficient feed in the stubbles to graze pigs. The informant inherited 4 hectares, and grazes his flock on common pasture and on others' property.

- Born 1922 the informant has always worked as an agricultural labourer except for a stint in Germany where he worked in construction. He worked under numerous landowners, starting at 10 years old as a *pastore* for a landowner grazing sheep and goats in the woods and uncultivated terrains, as well as on the stubbles and in the wheat February-March. He then switched jobs to work for another landowner grazing pigs. At that time there was little forest where he was grazing pigs; the land was largely tilled. The informant worked as a swineherd for several landowners, grazing pigs on untilled lands and on the plains in the stubbles. At 20 years old, he was conscripted into the military. The informant purchased a little land in 1959 where there was an established olive grove, adding almond trees and a vineyard.

- Born 1914, the informant's parents worked as agricultural labourers: his father as a hired hand, and his mother as a day labourer working in the fields. The informant finished second grade and half of the third when his father pulled him out of school to work with him. When the informant was 12 years old, his father took land in rent and began to work for himself. Married in 1938, the informant was called into the army in 1940. Later he became a prisoner of war and was eventually repatriated, returning home to a seven year old son. The informant found land to rent upon his return -- a difficult task given that the large landowners did not normally rent land because they had the capital to hire labourers and the necessary equipment: horses and ploughs. Those, like the informant who did not own a plough, had to work seven days hoeing to pay for one day's ploughing. There were few tractors post-war; almost everyone used mules, asses or oxen.

- The informant was always a landless agricultural labourer. He was pulled out of school at end of grade two to work.

- Born 1937, the informant always worked as a *pastore* under the *mezzadria* system. His father and grandfather were both salaried *pastori*. 50% of the mixed sheep/goat flock's production in cheese and offspring is his. The flock is composed of *c.* 240 sheep which are pure Comisane (milk producers) and *c.*170 goats.

- Born 1929, the informant worked as an agricultural labourer until he, his father and two brothers jointly purchased a farm. He then worked in Germany for three years and returned to purchase the farm from his brothers.

- Born 1911, the informant was an agricultural labourer as was his father. For fifteen years he worked under *mezzadria* system as a *pastore*. When the landowner died, the informant purchased the *masseria*.

- Born in 1914, the informant worked extensively for large proprietors with sheep and goats. Always a landless labourer, he worked as an agricultural labourer on a number of farms from mountain to the plain.

- The informant worked as a landless agricultural labourer and hired hand until he emigrated to Switzerland for work. After a 20 year absence, he returned and purchased farmland.

- Born 1909, the informant worked as a *pastore* on a large *masseria*. He acquired the bulk of his small property in 1948 through inheritance.

- The informant worked as a hired hand for a number of different landowners for 30 years, both in the capacity of *pastore* and as an agricultural labourer. He went to work in Germany for a number of years and with the money he earned there, he purchased the farm in 1963, adding a little bit every few years. A mixed farmer, the farm's primary production is in cheese and meat (lambs and kids).

- Born in 1924 to agricultural labourers, as a boy the informant grazed sheep and goats in the woods. The informant finished third grade and began to work with his father hoeing land that the family was renting. A poor family, they always ate bread made from corn (bread made from wheat was a Christmas treat). After WWII, he continued to work with his father on rented land until 1950 when he married. Once married, he worked all sorts of jobs while, at the same time, cultivating rented land. After two years' work in Germany, he was able to purchase some land. The household kept between 20-30 sheep (no goats), a milk cow, pigs for breeding for sale, a donkey, rabbits and chickens for domestic use.

- Born in 1925, the informant always worked with Podolian-breed cattle, as did his father and grandfather before him. The informant's son was born in 1950, and was withdrawn from school at 9 years of age to work with his father.

- The informant was born in 1921. This mixed farmer's family were always *pastori*. The informant's grandfather purchased the current property in 1920. However, his family lived in town and the distance to reach their land was excessive, so the family rented lands closer to town instead. The informant's father had also purchased property at current farm site which was willed to the informant. In 1959 the Italian State provided funds for the construction of a *masseria* on the lands themselves. Out of this program (the *case colonie* program was for those with lands distant from their town homes) they built the current *masseria* and moved on-site in 1960.

- Born 1918, and now pensioned, the informant always worked as a hired hand herding Podolian-breed cattle (for 50 years), always in the same zones.

- Born 1927, the informant worked mostly in agriculture and as a salaried *pastore*. He also worked 8 years in Germany which allowed him to purchase a 36 hectare property with his brother *c.* 25 years ago, and another 120 hectares in 1985. They also rent *c.* 40 hectares pasture of fallow and untilled lands. Jointly, he and his brother keep *c.* 400 sheep and 120 goats.

APPENDIX E

Preliminary Results of Ovicaprid Faecal Pellet Analysis

Due to time constraints, the data are incomplete. For this reason, only the appended Table and a few preliminary results are described. The plates additionally serve to illustrate the richness of the faecal pellets -- each photograph is of a single sample. I have included below an introduction to the faecal pellet study, a synopsis of the selection of sample sources which are more generally informative, and a description of the methods used.

During the initial months of field research I became increasingly aware of the impact of sheep and goats on the landscape, particularly the flora. A number of informants indicated that one particular plant or another had been brought into pastures by their flock. This information and my observations of flocks moving in their daily pasture rounds across the highly varied mosaic of vegetational zones, led me to collect sheep and goat faecal pellets to investigate their contents for evidence of ovicaprids' roles in disseminating plants across environments. It also seemed probable that the effect of the ruminant digestive process on seeds is pivotal to understanding the composition of the local flora.

Discussed in Chapter 5, my interest was heightened by the work of Lorenzo Salamone and Emilio Gambacorta at the Università degli Studi della Basilicata, and of Lorenzo Costantini (ISMEO, Rome). Their studies and mine provide supporting evidence of a mutualistic relationship between plants whose reproduction is largely dependent upon being consumed and digested, and the ovicaprids which consume it. This does not mean that "coevolution leads to obligate mutualisms" (Blumler 1996:28), but rather that those seeds which survive and benefit from the digestive process have been selected for through grazing by ruminants, in addition to drought and fire. The goal of the faecal pellet analysis is to test the hypothesis that a number of pasture plant species, characterized by their resistence to ruminant digestion and a consequent enhancement of their reproductive success, have been selected for under sustained grazing pressure by ovicaprids. The current study is restricted to investigating which seeds survive intact in the faecal pellets, while a forthcoming study shall investigate the viability of these seeds.

The Sample Sources: The Flocks, Their Environment and Grazing Systems

I selected four flocks in the vicinity of Oppido Lucano for sampling. Of these, one was selected as a control. This first flock, composed of Comisana cross Merino breed sheep (*c.* 200 head) is situated in the Bradano Trench at 326 m a.s.l.. A mixed farming operation, production is geared largely towards wheat and meat production. The property comprises over 150 ha of arable land in the valley (in two non-contiguous areas) which allows the owners to pursue an industrial-type stall-based system in that they have sufficient lands to cultivate both wheat for the market and large amounts of fodder for their animals. From December through to mid-June, this flock is almost entirely stall-fed hay composed of oats, barley and vetch,[1] the sheep are put into an outside enclosure on warm days where they browse on the little growth present while getting some sunlight.[2] During this period they also occasionally graze uncultivated fallow until May. However, after the grain harvest (June) until sowing (November at the low elevation of this farm), the animals graze stubbles and the emergent spontaneous growth both before and after burning. Hence, the production system also incorporates elements of traditional husbandry.

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[1] A cursory examination of the hay revealed that within this maslin hay crop occurs the occasional spontaneous plant of vetch, clover, medick, *Phalaris*, and *Lolium* sp.

[2] Attempts to intensify production to the stall-fed, barn system has not taken hold in Basilicata except in pig and cattle production. This farm was exceptional in the area.

While not a perfect control sample because the animals do graze in fallow lands and stubbles rather than consume only the hay provided to them in the stalls, that their diet is restricted to the maslin hay from mid- December through to the end of February is evident in the faecal pellet samples. This is the only flock sampled from the plains area, and the only flock sampled under this hybrid traditional/industrial - type production system. Because of the topography which is easily arable, the area is fully cultivated and the flock therefore does not have access to untilled land. Other than the hay, these animals consume only the spontaneous growth emergent in cultivated areas. Of note, however, is the five year fallow (E.E.C. set - aside program) which was grazed and in its fifth year during the period of sample collection.[3]

The second flock selected for faecal pellet collection is also composed of sheep only, breeds Comisana and Gentile di Puglia and their crosses. This flock of approximately 110 sheep is grazed under the traditional system, in which the *pastore* moves the flock across the full range of vegetation types present on his land (94 ha) on a daily basis. They graze starting at *c.* 680 m a.s.l. through oak copses, fallow, stubbles, *macchia*, down to the river Alvo, at *c.* 425 m a.s.l. and then return by a different route. Other fallow and stubbles are grazed within a half-kilometre radius of the farm. The flock is given hay supplements (vetch, clover, and oats; vetch, pea, oats maslins) during lambing and on wet, cold winter days when grazing is not ideal. Unlike the first flock, the preponderance of the diet is spontaneous vegetation, and production is geared to milk (cheeses) and lambs for the Christmas and Easter demand.

The third flock is grazed under a comparable system, although largely on privately-held lands not owned by the *pastore*. This flock is composed of mixed sheep (110) and goats (30). Like the second flock, production is geared to cheese and the sale of lambs and kids at Christmas and Easter. This flock of Comisana and Gentile di Puglia cross sheep, and "Local" breed goats (Rubino 1990:35), also grazes across the complete range of vegetation types. However, of the four flocks, this one receives the least supplemental feed (limited to straw).[4] The mixed flock grazes in a kilometre radius of the *ovile*, through oak copses, *macchia*, fallow and stubbles, at elevations of 730 m to 410 m a.s.l., and is watered at one of a number of public spring water fountains. Weak or sickly animals graze barley during the winter and early spring on a field adjacent to the fold for a couple of hours every morning, before they join the rest of the flock when it is turned out to graze.

The fourth flock is located on the outskirts of Oppido, composed of 55 sheep of Comisana crossed with Gentile di Puglia breed, and 45 "Locale" crossed with Ionica breed goats. These animals are grazed mostly on stubbles and fallow lands in the area. The *pastore* owns 7 ha of cultivated land just below the *ovile*, the fallow and stubbles of which are grazed as well as barley fields (lightly grazed until March). For the most part, the flock is grazed on others' lands at their request. The lands extend from 750 m to 545 m a.s.l. and because it is a rough topography, there are a number of untilled areas, some of which is *macchia*, other parts are small oak copses. As is typical of the lands close to town, the grazing range of this flock includes areas dominated by olive groves and vineyards, and the animals are strictly controlled to avoid their entering these. However, the faecal pellet contents from this flock reveal that the occasional incursion did occur. Again, lambing is timed for the Christmas and Easter market during which period ewes are fed barley and hay (spontaneous) mixed with straw. Part of the rationale for this feeding in winter is also to curb too rapid an ingestion of grasses once they leave their fold in the morning when there is still dew on the plants. The main product of this flock is milk for cheese.

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[3] The spontaneous vegetation emergent from the soil seed set had all the necessary time to develop and set seed. The E.E.C. program was designed to include four ploughings over the course of the year. However, most did not undertake this as it would have involved a heavy expenditure in diesel. With applications of herbicides, the accumulated "weeds" could be eliminated in the wheat rotation. Some informants indicated that they cut the spontaneous growth from the fallow for hay and thereby reduced the number of seeds set during the fallow. However, only those fields in which grew concentrations of favoured spontaneous fodder (*Lolium, Lathyrus, Phalaris, Trifolium, Medicago,* etc.) would be cut for hay.

[4] This is unusual as all other flocks visited receive supplementary feed -- especially during lambing. Discussion with another informant about the practises of this *pastore* he acknowledged that supplementary feeding of sheep and goats was less common in the past that it is today. Nevertheless, the *pastore*'s practise of not providing feed was viewed unfavourably.

Of the 72 samples collected, four are from flocks other than the above. Three are from the area of San Cataldo di Bella. The San Cataldo samples were collected on 03 July 1994 when I was in the community conducting interviews. One sample was collected from a flock of mixed sheep and goats that was grazing along the road, at the edge of an oak-beech forest. The provenance of the second sample is a small flock of sheep kept for the most part in an enclosure where they were fed spontaneous hay, but also graze fallow, untilled land, and stubbles. This is similar to the flock which produced the third sample, although these sheep and goats predominantly graze on fallow and stubbles as well as in oak copses. The fourth sample was collected from a freely grazing flock of sheep at a farm between Oppido Lucano and Pietragalla at elevations of 640 m to 440 m a.s.l. At the time of the collection (21 June 1994) the cereals and hay had been harvested. These animals cross stubbles, fallow, untilled land including oak copses and range relatively freely, being monitored from afar to make certain they do not enter vineyard, olive groves or vegetable gardens, nor fields of maturing cereals.

Methods

I began collecting faecal pellet samples from sheep and goat flocks in the study area out of a sense of frustration with interpretations of archaeobotanical data published in site reports, and to determine whether their seed content parallelled that present in archaeological contexts. As noted above, this research goal expanded to include examining the role of sheep and goats in disseminating plant species across the landscape, and hence their role as colonizers. A month following the initial collection begun in June, I began a more systematic collection to insure sufficient samples for statistical analysis, collecting 30 g samples from sheep and goats from each of four flocks on a bimonthly basis over the course of my fieldwork. Two of these flocks are composed entirely of sheep, while the other two are mixed sheep and goats. Unlike pellets from stall-fed animals (see Rasmussen 1993), sheep and goats' diets in the mixed flocks were sufficiently similar that their faecal pellets could be confused. For this reason, sheep and goat faecal pellets from the mixed flocks were collected (as well as processed and analysed) separately.

Pellet samples were air dried on cardboard trays and then bagged for later processing. Anticipating a return to Canada by the end of 1994, I applied for an import permit (Agriculture Canada# 94-09-SPB-11) which granted me permission to mail the dried samples in "raw" form to the University of Alberta for analysis by 25 November, the week prior to my original return date.[5] I later extended the fieldwork period. The samples collected from 06 June to 13 November 1994, were mailed while the permit was still valid. Samples collected after the permit expired were prepared in my apartment kitchen in Oppido Lucano.

In addition to these later samples (November 1994 - March 1995), I had samples in excess of the 30 g minimum dry pellet weight which I had mailed to Canada under the permit. These surplus pellets I also processed in Oppido during my stay to test the reliability of the methods used in Oppido. That is, I wanted to establish a database to check that the samples processed in Oppido did not vary from those processed under proper laboratory conditions in

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[5] I owe a great debt to Dr. William Page of the Department of Biological Sciences (University of Alberta) for arranging for the use of the department's Bio-hazard Facilities. This was instrumental in gaining the import permit.

Canada.[6] If the samples are congruent, then the data from later samples collected during the November 1994 - February 1995 period can be incorporated with the June - November sample data.

Sample size sent for laboratory analysis at the University of Alberta was determined by weight (35 g/sample). However, given winter conditions and lack of access to drying racks, samples processed entirely in Oppido (November 1994 - February 1995) were processed wet and for consistency, were based on a set number of faecal pellets. 30 pellet samples were collected from 27 November until 24 December 1994, a number which, upon drying would constitute approximately 15 g samples. In fact, I had decided only as late as January to amalgamate this data set with that from the June - November 1994 rather than treating them as separate databases. Therefore, from 08 January until 19 February 1995, 60 pellet samples were collected to meet the 30 g minimum dry weight collection undertaken previously.

I measured the sample weights after processing and drying (see below). The weight of these samples (averaged 0.5 g/processed pellet) is roughly comparable to the dried whole pellet samples (averaged 0.53 g/dry whole pellet). The variance may be due to seasonal dietary differences as well as the loss of bile and bits of plant matter smaller than the .25 mm screen used in processing. As is clear from the data, the weight of faecal pellets varied between flocks and throughout the course of the year. Changes in size and consistency, weight/pellet also vary significantly seasonally, with diet and also with the reproductive cycle of the sheep. Of those samples measured, the greatest weight per faecal pellet was 1.06 g/pellet (09 August sample) and the lowest was 0.26 g/pellet (06 September 1996).[7]

Each sample of pellets was processed, dried and weighed in my Oppido kitchen. Samples were crushed lightly to break open the faecal pellets in order to allow water to penetrate.[8] Once softened in water, they were washed in a 0.25 mm sieve until thoroughly unbound from their matrix. The sieve contents were then transferred to cardboard trays and spread for drying. Once dried, all seeds and seed fragments were extracted with forceps, as well as any other material that might survive in an archaeological context (rachises, stem fragments, pebbles, etc.) and stored in labelled plastic envelopes.

The problem of varying sample size shall be mitigated by measuring seed representation/faecal pellet. The proportion of seeds of various types present in one faecal pellet shall be measured. To this total shall be added the results of a second faecal pellet, then a third, and so on, until the cumulative percentage of each seed type represented no longer varies. Using this cumulative sampling method (van der Veen and Fieller 1982), I shall determine the number of faecal pellets required for a representative sample, and therefore, I shall be able to ascertain if sample size is adequate and, on the basis of percentage representation, if they are comparable. The remainder of the sample will then spot-checked for seeds not present within the representative sample.

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[6] The mailed samples have yet to be processed and analysed fully. Once analysis is completed, the results shall be published separately.

[7] These variations and the fluctuating sample size may well affect the results. However, comparisons between different sample sizes from the same collection will clarify if each is sufficient to provide a representative sample (presence and ratios of seed types and percentages).

[8] For the samples yet to be processed (those mailed to the University of Alberta) I shall avoid using crushing these pellets while dry to avoid damaging seeds through this mechanical action. Instead I shall mist the samples heavily before crushing them. While I do not believe that the method used in Oppido to crush the pellets significantly affected the seeds they contained, I want to insure that the integrity of the seeds in the samples are not compromised by the processing (and through comparison, that the pellet crushing of the Oppido samples did not damage seed integrity).

A Note on Some Preliminary Observations:

June, July and August samples are particularly rich in seeds, and especially of legumes and amaranths. The control sample of almost exclusively stall-fed sheep is easily distinguishable from the other samples. Their faecal pellets yield almost exclusively vetch and barley seeds, and few spontaneous plant seeds. However, during their late summer grazing in on-farm stubbles, they consumed vast quantities of amaranth, a large proportion of which they excreted in their faeces. Amaranths appear in all samples for the same period, which is not surprising given the universal practise of taking flocks to graze stubbles. In fact, crop "weeds" dominate the samples over the summer. Throughout the samples collected during the summer are also found abundant legumes. Winter samples show a more varied diet and are less seed rich. The samples from the flock which is given little in terms of supplementary feed is the most varied in composition. The maximum consumption and dispersal of seed, at least on the basis of these preliminary observations, occurs during the most extensive period of grazing in arable lands.

APPENDIX E: Table E1
Preliminary results of identified seeds from ovicaprid faecal pellet samples

SAMPLE #	Agrostis sp	Alopecurus sp.	Amaranthus sp.	Amaranthus graecizans	Amaranthus retroflexus	Anthemis sp.	Arum maculatum italicum	Astralagus sp.	Atriplex sp.	Avena sp.	Avena fatua	Avena sativa	Beta maritima	Bifora radians	Brassica sp.	Bromus sp.	Capparis sp.	Carex sp.	Centaurea sp.	Cirsium sp.	Chenopodium sp.	Coriandum sativum	Coronilla scorpioides	Crataegus sp.	Cyperus sp.	Dactylis sp.	Euphorbia maculata	Foeniculum sp.	Fumaria sp.	Galeopsis sp.	Galium sp.	Hordeum sativum	Lathyrus sp.	Linum usitatissimum	Lithospermum arvense	Lolium sp.	Malva pusilla/rotundifolia	Medicago sp.	Medicago falcata/sativa	Medicago minima	Medicago orbicularis	Medicago polymorpha	Medicago scutellata
3																					X																						
6																				X												X									X	X	
13																																X											
16																					X																						
18			X																		X									X				X									
23			X																											X		X											
31			X																																X							X	
39			X									X																										X					
46																																X											
49												X																				X											
55																																X											
66																					X											X											
70												X			X																	X											
7																																								X		X	
11				X	X							X		X							X	X					X	X						X	X		X				X		

SAMPLE #	Melilotus sp.	Myosotis discolor	Olea europaea	Panicum sp.	Papaver sp.	Phalaris sp.	Picris sp.	Pisum sp.	Plantago sp.	Plantago lanceolata	Poa sp.	Portulaca oleracea	Polygonum sp.	Ranunculus sp.	Rubus sp.	Rumex sp.	Saponaria vaccaria	Scorpiurus muricatus	Silene sp.	Sinapis sp.	Solanum sp.	Sonchus sp.	Trifolium sp.	Trifolium alexandrinum	Trifolium arvense	Trifolium angustifolium	Trifolium campestre	Trifolium hybridum	Trifolium incarnatum	Trifolium pratense	Trifolium repens	Trifolium tridentatum	Trigonella sp.	Triticum sp.	Viola sp.	Vicia sativa	Vitis vinifera	Rachises (cereal)	Tree bark (oak)
3	X												X																							X		X	
6														X																									
13													X																							X			
16													X																										
18																																							
23																																						X	
31																																							
39		X																																		X		X	
46						X																														X		X	
49																																				X		X	
55																																				X		X	
66																																				X			
70																																				X		X	
7		X			X				X	X									X				X		X		X	X		X	X								X
11						X	X					X	X																	X				X		X			

The plant seed species thus far identified are listed with a few representative samples below. The completed results are to be published at a later date.

Appendix E: Table E2
Cereal Crop Herbicide Targets and Faecal Pellet Constituents

"WEED" SPECIES

Botanical name	Family	Common name	Faecal Pellets
Abutilon avicennae Gaertner (= *A. theophrasti*)	Malvaceae	Velvet leaf	?
Adonis aestivalis	Ranunculaceae	Pheasant's Eye	?
Aethusa cynapium L.	Umbelliferae		P
Agropyron repens (L.) Beauv.	Gramineae	Quackgrass	P
Agrostis spica-venti L.	Gramineae	Millet grass	P
Alopecurus geniculatus L.	Gramineae		
Alopecurus myosuroides Hudson	Gramineae		P
Amaranthus retroflexus L.	Amaranthaceae	Pigweed	X
Ammi majus L.	Umbelliferae		?
Anagallis arvensis L. (= *A. phoenicea* Scop.)	Primulaceae		P
Anagallis foemina Miller (= *A. coerulea*)	Primulaceae		
Anethum graveolens	Umbelliferae	Dill, False Fennel	P
Anthemis arvensis L.	Compositae	Corn Chamomile	X
Atriplex spp.	Chenopodiaceae	Saltbush	P
Avena elatior L. (= *Arrhenatherum elatius*)	Gramineae		P
Avena fatua L.	Gramineae	Wild Oat	X
Avena sterilis L.	Gramineae		X
Beta maritima	Chenopodiaceae	(*B. vulgaris*)	[X]
Bifora radians	Umbelliferae		X
Bromus hordeaceus L. (= *Bromus mollis* L.)	Gramineae		
Bromus sterilis L.	Gramineae		P
Capsella bursa pastoris (L.) Medicus	Cruciferae	Shepherd's Purse	?
Centaurea cyanus	Compositae	Cornflower	P
Cerastium arvense	Caryphyllaceae		?
Chenopodium album L.	Chenopodiaceae	Lambsquarters	[X]
Chenopodium ficifolium Lam. (= *C. olidum*; *C. vulvaria*)	Chenopodiaceae		[X]
Chenopodium opulifolium Shrader	Chenopodiaceae		[X]
Chenopodium polyspermum L.	Chenopodiaceae		[X]
Chrysanthemum segetum	Compositae	Corn Marigold	P
Cirsium arvense (L.) Scop.	Compositae		X
Convolvulus arvensis	Convolvulaceae	Bindweed; Cornbine	X
Convolvulus sepium L. (= *Calystegia sepium*)	Convolvulaceae		
Cynodon dactylon (L.) Pers.	Gramineae	Bermudagrass	P
Daucus carota	Umbelliferae	Wildcarrot	
Digitaria sanguinalis (L.) Scop	Gramineae	Crabgrass	P
Diplotaxis spp.	Cruciferae	Wall Rocket	P
Euphorbia helioscopia L.	Euphorbiaceae	Spurge?	[X]
Euphorbia peplus L.	Euphorbiaceae		[X]
Fumaria officinalis L.	Papaveraceae	Fumitory	X
Galeopsis tetrahit L.	Labiatae	Hemp nettle	P
Galium aparine L.	Rubiaceae	Bedstraw	P
Geranium dissectum hyp.	Geraniaceae	Cranesbill geranium	P
Holcus lanatus L.	Gramineae	Velvetgrass	P
Holcus mollis L.	Gramineae		P
Hordeum murinum L.	Gramineae		P
Lamium amplexicaule L.	Labiatae		?
Lamium purpureum L.	Labiatae	False nettle	?
Lithospermum officinale	Boraginaceae	Gromwell	X
Lolium italicum A. Br. (= *L. multiflorum* Lam.)	Gramineae	Bearded Ryegrass	P
Lolium perenne (L.)	Gramineae	Ryegrass	P
Lolium remotum Schrank	Gramineae		P
Lolium rigidum Gaud.	Gramineae	Ryegrass	P
Lolium temulentum L.	Gramineae		P
Matricaria chamomilla L. (= *Chamomilla recutita*)	Compositae		P
Mentha arvensis L.	Labiatae		?
Mercurialis annua L.	Euphorbiaceae	Mercury	
Myagrum perfoliatum L.	Cruciferae		?
Myosotis arvensis (L.) Hill (= *M. intermedia* Link)	Boraginaceae	Forget-me-not	X
Oxalis cernua (*O. pes-caprae*)	Oxalidaceae	Sorrel	?
Panicum capillare L.	Gramineae	Witchgrass	P
Panicum crus-galli L. (= *Echinochloa crus-galli*)	Gramineae	Panicum	P
Panicum dichotomiflorum Michx.	Gramineae	Panicum	P
Papaver rhoeas L.	Papaveraceae	Corn Poppy	X
Phalaris spp.	Gramineae	Canary Grass	X
Phalaris brachystachys L.	Gramineae		
Phalaris minor Retz.	Gramineae		X
Phalaris paradoxa L.	Gramineae	Meadow Grass	
Poa annua L.	Gramineae	Annual Bluegrass	P
Poa pratensis L.	Gramineae	Kentucky Bluegrass	P
Poa trivialis L.	Gramineae		P
Polygonum aviculare L.	Polygonaceae	Knotgrass/-weed	[X]
Polygonum convolvulus L. (= *Fallopia convolvulus*)	Polygonaceae	Cornbind	X
Polygonum lapathifolium L.	Polygonaceae		[X]
Polygonum persicaria L.	Polygonaceae		[X]
Portulaca oleracea L.	Portulacaceae	Purslane	X
Ranunculus arvensis	Ranunculaceae	Corn Crowfoot	
Ranunculus repens L.	Ranunculaceae	Creeping Buttercup	X
Raphanus raphanistrum L.	Cruciferae	Wild Radish	P
Rapistrum rugosum	Resedaceae		
Rumex crispus L.	Polygonaceae	Dock	[X]
Rumex obtusifolius L.	Polygonaceae		[X]
Scandix pecten-veneris	Umbelliferae		
Senecio vulgaris L.	Compositae		
Setaria verticillata (L.) Beauv. (= *Panicum verticillatum*)	Gramineae	Bristlegrass	P
Setaria viridis (L.) Beauv. (*Panicum viride*)	Gramineae	Bristlegrass	P
Silene alba (Miller) Krause	Caryphyllaceae		X
Sinapis alba (= *Lycnis alba* Miller)	Cruciferae		X
Sinapis arvensis L.	Cruciferae	Charlock	X
Solanum nigrum L.	Solanaceae	Nightshade	[P]
Sonchus arvensis L.	Compositae		P
Sonchus oleraceus L.	Compositae		X
Sorghum halepense (L.) Pers.	Gramineae	Johnsongrass	
Spergula arvensis L. (*S. vulgaris*; *S. maxima*)	Caryophyllaceae	Spurry	
Spergula sativa Boenn.	Caryophyllaceae		
Stellaria media (L.) Vill	Caryophyllaceae	Chickweed	X
Thlaspi arvense L.	Cruciferae		?
Thlaspi perfoliatum L.	Cruciferae		?
Trifolium spp.	Leguminosae	Clover	X
Tussilago farfara L.	Compositae		?
Urtica dioica L.	Urticaceae		P
Urtica urens L.	Urticaceae		
Veronica hederifolia L.	Scofulariaceae		P
Veronica persica L. (= *V. buxbaumii*; *V. tournefortii*)	Scofulariaceae	Speedwell	
Vicia sativa/spp.	Leguminosae	Vetch	X
Viola arvensis Murray	Violaceae		
Viola tricolor	Violaceae	Wild Pansy	
Xanthium italicum Moretti (= *X. echinatum* Auct.)	Compositae		
Xanthium strumarium L.	Compositae		

P = Tentative identification (possible); X = Identified as present. [X] = Another variety

Appendix E: Table E3
Ovicaprid Faecal Pellet Samples Processed Oppido Lucano

SAMPLE #	FLOCK NAME/LOCATION	COLLECTION DATE	SHEEP/GOAT	WEIGHT (g)	WET/DRY	# PELLETS	Weight g/faecal pellet	Av. weight/dry faecal pellet
1	Mass. la Sala -- Oppido Lucano	Jun-94	S	20	D			
2	Mass. del Notaio -- Oppido Lucano	07-Jun-94	S	10	D			
3	Mass. Cassano -- Oppido Lucano	21-Jun-94	S	8	D			
4	Mass. la Sala -- Oppido Lucano	21-Jun-94	S	50	D			
5	Comforte -- S. Cataldo di Bella	03-Jul-94	S	80	D			
6	Carlucci -- S. Cataldo di Bella	03-Jul-94	S+G	25	D			
7	Salinardi -- S. Cataldo di Bella	03-Jul-94	S	45	D			
8	Mass. Cassano -- Oppido Lucano	07-Jul-94	S	12	D			
9	Evangelista -- Oppido Lucano	10-Jul-94	S	10	D			
10	Mass. Cassano -- Oppido Lucano	10-Jul-94	S	38	D			
11	Sparacannone -- Oppido-Pietragalla	21-Jul-94	S	60	D			
12	Mass. la Sala -- Oppido Lucano	24-Jul-94	S	40	D			
13	Mass. Cassano -- Oppido Lucano	24-Jul-94	S	24	D			
14	Mass. la Sala -- Oppido Lucano	08-Aug-94	S	28	D			
15	Evangelista -- Oppido Lucano	08-Aug-94	S	18	D	17	1.058	
16	Mass. Cassano -- Oppido Lucano	08-Aug-94	S	18	D	54	0.33	
17	Mass. la Sala -- Oppido Lucano	06-Sep-94	S	50	D			
18	Mass. Cassano -- Oppido Lucano	06-Sep-94	S	28	D	99	0.28	
19	Evangelista -- Oppido Lucano	06-Sep-94	G	30	D			
20	Mass. la Sala -- Oppido Lucano	18-Sep-94	S	23	D	42	0.55	
21	Mass. del Notaio -- Oppido Lucano	18-Sep-94	S	20	D	28	0.71	
22	Evangelista -- Oppido Lucano	18-Sep-94	S	14	D			
23	Mass. Cassano -- Oppido Lucano	18-Sep-94	S	25	D			
24	Mass. la Sala -- Oppido Lucano	02-Oct-94	S	16	D	45	0.36	
25	Mass. la Sala -- Oppido Lucano	16-Oct-94	S	16	D	21	0.76	
26	Evangelista -- Oppido Lucano	16-Oct-94	S	18	D			
27	Mass. la Sala -- Oppido Lucano	30-Oct-94	S	33	D	54	0.61	
28	Evangelista -- Oppido Lucano	31-Oct-94	G	18	D	46	0.39	
29	Evangelista -- Oppido Lucano	31-Oct-94	S	32	D	108	0.3	
30	Mass. del Notaio -- Oppido Lucano	31-Oct-94	S	28	D			0.53
31	Mass. Cassano -- Oppido Lucano	27-Nov-94	S		W	30		
32	Evangelista -- Oppido Lucano	27-Nov-94	G		W	30		
33	Evangelista -- Oppido Lucano	27-Nov-94	S		W	30		
34	Mass. del Notaio -- Oppido Lucano	27-Nov-94	S		W	30		
35	Mass. del Notaio -- Oppido Lucano	27-Nov-94	G		W	30		
36	Mass. la Sala -- Oppido Lucano	27-Nov-94	S		W	30		
37	Mass. del Notaio -- Oppido Lucano	12-Dec-94	G		W	30		
38	Mass. del Notaio -- Oppido Lucano	12-Dec-94	S		W	30		
39	Mass. Cassano -- Oppido Lucano	12-Dec-94	S		W	30		
40	Evangelista -- Oppido Lucano	12-Dec-94	G		W	30		
41	Evangelista -- Oppido Lucano	12-Dec-94	S		W	30		
42	Mass. la Sala -- Oppido Lucano	12-Dec-94	S		W	30		
43	Mass. del Notaio -- Oppido Lucano	24-Dec-94	S		W	30		
44	Mass. del Notaio -- Oppido Lucano	24-Dec-94	G		W	30		
45	Mass. la Sala -- Oppido Lucano	24-Dec-94	S		W	30		
46	Mass. Cassano -- Oppido Lucano	24-Dec-94	S		W	30		
47	Evangelista -- Oppido Lucano	24-Dec-94	S		W	30		
48	Evangelista -- Oppido Lucano	24-Dec-94	G		W	30		
49	Mass. Cassano -- Oppido Lucano	08-Jan-95	S		W	50		
50	Evangelista -- Oppido Lucano	08-Jan-95	S		W	60		
51	Evangelista -- Oppido Lucano	08-Jan-95	G		W	60		
52	Mass. del Notaio -- Oppido Lucano	10-Jan-95	S		W	60		
53	Mass. la Sala -- Oppido Lucano	10-Jan-95	S		W	60		
54	Mass. del Notaio -- Oppido Lucano	10-Jan-95	G		W	60		
55	Mass. Cassano -- Oppido Lucano	20-Jan-95	S		W	60		
56	Mass. la Sala -- Oppido Lucano	20-Jan-95	S		W	60		
57	Evangelista -- Oppido Lucano	20-Jan-95	G		W	60		
58	Evangelista -- Oppido Lucano	20-Jan-95	S		W	60		
59	Mass. del Notaio -- Oppido Lucano	20-Jan-95	S		W	60		
60	Mass. del Notaio -- Oppido Lucano	20-Jan-95	G		W	60		
61	Mass. del Notaio -- Oppido Lucano	05-Feb-95	G	35	D	60	0.58	
62	Mass. del Notaio -- Oppido Lucano	05-Feb-95	S	35	D	60	0.58	
63	Mass. la Sala -- Oppido Lucano	05-Feb-95	S	35	D	60	0.58	
64	Evangelista -- Oppido Lucano	05-Feb-95	S	35	D	60	0.58	
65	Evangelista -- Oppido Lucano	05-Feb-95	G	35	D	60	0.58	
66	Mass. Cassano -- Oppido Lucano	05-Feb-95	S	35	D	60	0.58	
67	Mass. del Notaio -- Oppido Lucano	19-Feb-95	S	25	D	60	0.41	
68	Mass. del Notaio -- Oppido Lucano	19-Feb-95	G	25	D	60	0.41	
69	Evangelista -- Oppido Lucano	19-Feb-95	S	30	D	60	0.5	
70	Mass. Cassano -- Oppido Lucano	19-Feb-95	S	25	D	60	0.41	
71	Evangelista -- Oppido Lucano	19-Feb-95	G	25	D	60	0.41	
72	Mass. la Sala -- Oppido Lucano	19-Feb-95	S	25	D	60	0.41	0.5

Plate E1. From 60 g (dry) sheep sample. Collected from Sparacannone 21 July 1994.
Amaranthus retroflexus; *Chenopodium* sp.; *Triticum* sp; *Phalaris* sp.; *Trifolium* spp.; *Malva parviflora*.

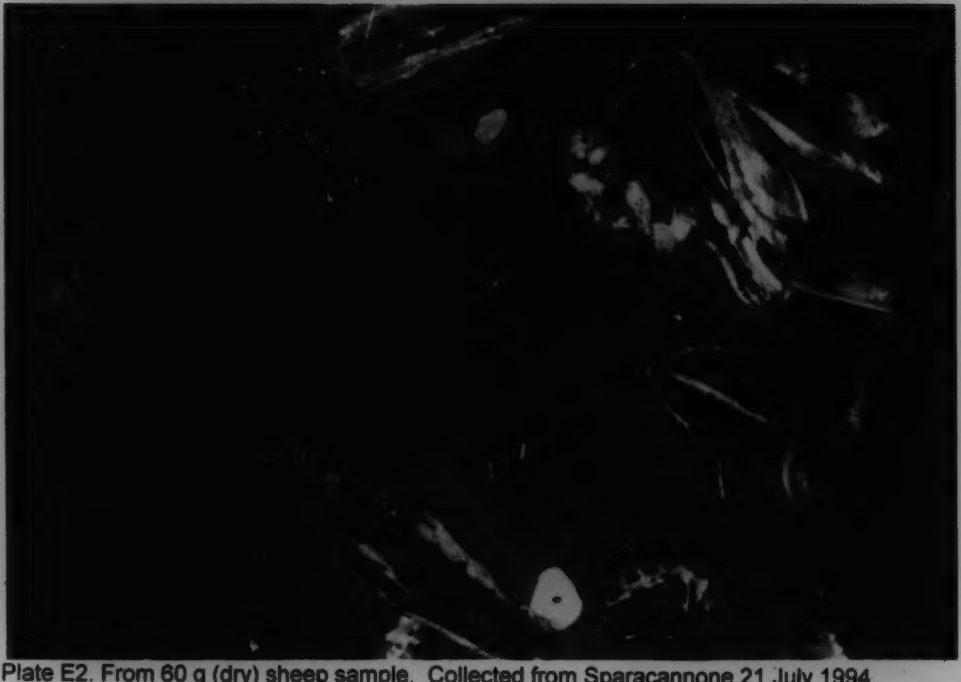

Plate E2. From 60 g (dry) sheep sample. Collected from Sparacannone 21 July 1994.
Amaranthus spp.; *Chenopodium* sp.; *Linum usitatissimum*; *Malva parviflora*; *Picris* sp.; *Polygonum* sp.; Umbelliferae (unident.).

Plate E3. From 45 g (dry) sheep sample. Collected from Salinardi (S. Cataldo). 03 July 1994.
Papaver sp.; *Plantago* spp.; *Trifolium* spp.

Plate E4. From 18 g (dry) goat sample. Collected from Evangelista. 31 October 1994.
Chenopodium album; *Polygonum* sp.; *Teucrium* sp. (?).

Plate E5. From 60 g (dry) goat sample collected 10 January 1995 from Mass. del Notaio. *Crataegus* sp.; *Rubus* sp.

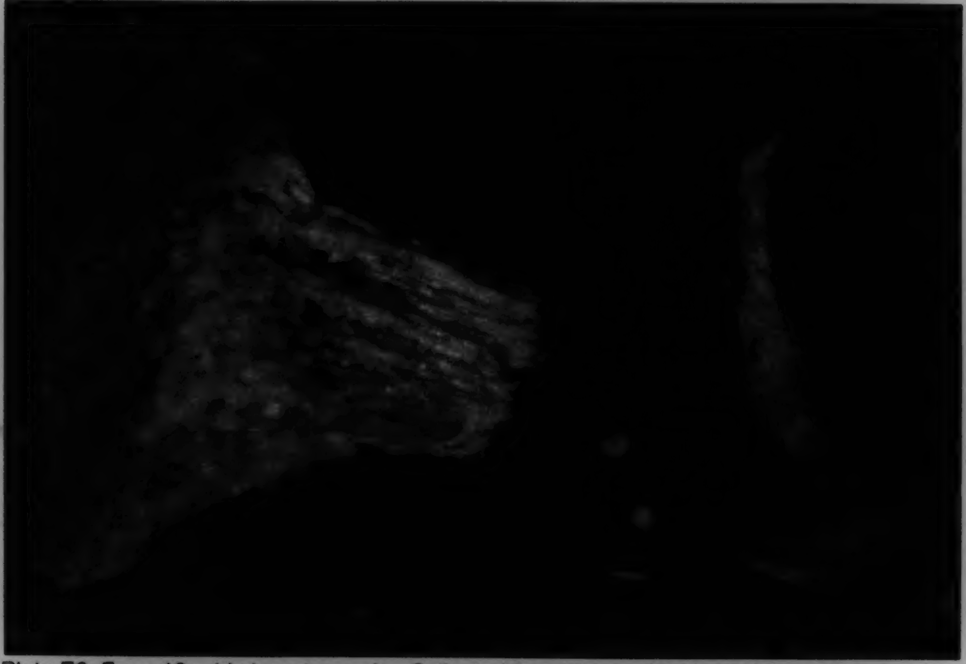

Plate E6. From 18 g (dry) goat sample. Collected from Evangelista 31 October 1994. *Rubus* sp. Spines; *Amaranthus graecizans* L.

APPENDIX F

DEFINITIONS

Agro-ecosystems "may be defined as ecological ecosystems modified by human beings to produce food, fiber and other agricultural products. In the transformation, the great diversity of wildlife in the original natural system is reduced to a restricted assemblage of crops, pests and weeds. The basic ecological processes -- competition, herbivory and predation -- still remain, but these are now overlain and regulated by . . . agricultural processes (Conway and McCracken 1990:221).

> In agroecosystems there is considerable overlap of function between different organisms. If a single species is removed the system may continue to function almost as though nothing has happened. Furthermore, the biological components of an agroecosystem are adaptive -- they can change the way they function with respect to other parts of the agroecosystem as the need arises, e.g. disease and pest resistance (Squires 1991:9).

Annual cropping "may be practiced wherever and whenever there is sufficient precipitation each year to produce a crop. Annual cropping involves growing a crop each years in successive years" (Isom and Worker 1979:202).

'**Arable**' and '**cultivation**' are both used here to distinguish **plough** or **tillage** cultivation (arable) from "**cultivation**" which is used herein to include plant propagation and management technologies such as prescribed burning and controlled grazing. Cultivation and tillage can also be used in the same lands. In fallow arable lands, for example, these tend to be both tilled (ploughed) and cultivated through the use of fire and grazing animals.

Bare fallow "By repeated working of the land is kept free of all living vegetation and is finally prepared for seeding. Such fallowing is usually known as clean or bare fallowing. [. . . .] In other areas, the period of working the fallow is reduced. Stubble and weeds are often used for grazing, and the working of the fallow does not commence until all grazing has been used up a few months before seeding the new crop" (de Brichambaut 1970:26). *It is the latter which is practised as "bare" fallow in the Basilicata area.*

Browse "commonly means forage from woody plants including sprouts, young twigs, leaves, flowers, fruits, and even bark. The terms fodder trees and fodder shrubs are synonyms for browse" (Jones 1987:140).

Carrying capacity "is defined as the maximum number of animals that an area of land can support on a sustainable basis. It can be expressed numerically as a stocking rate. Although a dynamic concept, dependent on climate, site quality and production goals . . ." (Hocking *et al.* 1992:708).

Coevolution is defined as ". . . an evolutionary process in which the establishment of a symbiotic relationship between organisms, increasing the fitness of all involved, brings about changes in the traits of organisms" (after Rindos 1984, Naveh and Kutiel 1989).

Crop rotation is the "alternating [of] different crops in the same field during different seasons or years . . ." (Isom and Worker 1979:217).

Dryland farming is ". . . the farming practised in those regions where the insufficiency and variability of rainfall are the principal limiting factors in agricultural production . . . " (de Brichambaut 1970:20).

Evapotranspiration "(ET) refers to the loss of water from a moist soil by the combined processes of vapour transfer away from the soil surface (evaporation, E), and water withdrawal from the soil by plant roots followed by vapour transfer away from the leaf surfaces (transpiration, T)" (Jury 1979:184).

Feed is defined here as grains (both legume and cereal) as well as corn (*Zea mays*) which are stall-fed to livestock.

Fire regime is ". . . characterized by a particular vegetative ensemble and regular patterns of fire behavior" (Pyne 1982:xii).

Fodder "is the dried, cured plants (including leaves, stems, and grain heads) of tall, coarse-grained crops such as maize, sorghum, wheat, and soybeans" (Jones 1987:140).

Food is used to specify exclusively human food.

Forage "is an all-encompassing term for plant parts, both woody and herbaceous, that are eaten by animals. Forage can be grazed or harvested for later feeding" (Jones 1987:140).

Green manure (***la sovescia***) is a legume grown until it the seeds have formed, but have yet to mature, that is then turned into the soil as a fertilizer.

Herbaceous plants "are vascular plants that do not develop woody tissue" (Jones 1987:140).

Intercropping "is a system in which two or more crops are grown simultaneously in rows in a definite pattern" (Isom and Worker 1979:206).

Maslin (see mixed cropping).

Mediterranean climate is ". . . characterized by winter rainfall (250-350 mm - 600 mm) and by completely dry summers with high evapotranspiration" (de Brichambaut 1970:23).

Mixed cropping ". . . the system under which two or more crops are grown simultaneously with no row arrangement " (Isom and Worker 1979:206), also referred to as a **maslin.**

Pastore is used to refer to shepherd and/or goatherd. It is the Italian generic term for a herder, the plural form of which is ***pastori***.

> In defining pastoralists, anthropologists have generally focussed on two characteristic variables: degree of dependence upon domestic animals and mobility (see Dyson-Hudson 1972; Dyson-Hudson and Dyson-Hudson 1980 . . .; Spooner 1973). These variables have been used in endless attempts to classify pastoral groups. This practice has resulted in the unfortunate and intellectually sterile debates that normally ensue when academics are faced with the needs of "splitting" or "lumping" behavioral categories (Chang and Koster 1986:98-99).

Pasture is herein used to mean any area grazed by animals. Pasture is typically defined as ". . . more or less permanent grass-legume associations utilized by grazing" (Wheeler 1981:240). Basilicata pastures (South Italy and the Mediterranean as a whole) are anthropogenic in nature.

Prescribed burning is a controlled burn under conditions which result in a known and desired result.

Pyrophytes: ". . . plants whose propagation, multiplication or reproduction is stimulated by fire, or which can resist fire by various mechanisms" (Le Houérou 1981:490).

Resilience is ". . . the process of restoration of initial structure and function after a disturbance or period of stress. . . . disturbance often refers to the impact of human activities . . . . stresses or disturbances can be annual fluctuations about a mean . . . refer to rare natural events such as landslips, volcanic eruptions, floods . . . . stress can be used to embrace both the applied force and the response of the biota" (Dell *et al.* 1986:2).

Sustainability "is the capacity of a region to maintain the diversity and biomass of a characteristic biota within the dynamic equilibrium of regular production cycles. Variation over time in the constituent species populations, including humans . . ." (Sean Cadigan @ the Eco-Research Program at Memorial University of Newfoundland = scadigan@morgan.ucs.mun.ca. X-UIDL: 823019908.019 on Mon., 29 January 1996 13:09:49 CST).

Tillering is the production of "'tillers' or side shoots from the root or base of the stem" . . . "of the stalk of corn [meaning wheat] or grass or other herbaceous plant" (Oxford English Dictionary 1973:2306).

Weeds "are colonising species capable of occupying otherwise unoccupied space" (Guillerm 1991:379). "Weeds are both specialist species, co-evolved with cultivation, as well as being generalist species in terms of invasion" (Guillerm 1991:387).

Woody plants "are vascular plants such as shrubs, woody vines, or trees that contain woody tissue (i.e., persistent ligneous material)" (Jones 1987:140).